RAILROAD GAZETTE

SATURDAY, SEPTEMBER 14, 1872.

A Description of the Proposed Plan for Erecting the Superstructure of the Illinois & St. Louis Bridge.

[A paper read by Walter Katte, C. E.,* Member of the American Society of Civil Engineers, at the Fourth Annual Convention held in Chicago, June 5 and 6, 1872, and published by the Society.]

The problem of how to sustain and maintain in position the arch ribs of the Illinois & St. Louis Bridge, during the progress of their erection, is one regarded by all engaged upon the construction of the truly great work as second only, if not equal, in importance and interest, to the one completed in so signally successful a manner—the sinking of the piers and abutments to their foundations on the bed rock.

After the most careful study of all the conditions under which this work has to be performed, a plan has been adopted, the prominent features of which, divested as much as possible of the minutiæ of detail, it is the object of this paper to describe.

The most prominent novelty in this plan consists in the absence of all scaffolding or trestling standing in the river, excepting only for a very short distance immediately adjacent to the piers and abutments, substituting therefor a suspending system, from above; also in using the inherent stiffness of the arch ribs themselves as cantilevers (aided, if found necessary, by temporary "guys" from the piers and abutments), to support the derricks and stages from which to project forward the successive sections of the ribs.

The reasons which led to this radical departure from all the usual types of "falseworks" are found in a consideration of the unstable and insecure foundation offered by the shifting sand of the river bed, which—liable to deep and sudden scour at every flood—precludes the use of any system of trestling or piling, unless carried down to the bed rock at an enormous outlay, not only in expensive material and workmanship actually consumed in the works themselves, but also for the subsequent removal of the same, and the loss of large quantities of material which could not be recovered except at unremunerative expense; also in the cost and maintenance of an effective system of protection works to guard the "falseworks" proper from the danger of colliding rafts and river craft, all of which would have to be placed in position and again removed three successive times, in the deep and rapid current of the Mississippi River; the exigencies of the crowded river traffic in this the very center of the harbor of St. Louis not permitting the closing of more than one span at a time.

Under these considerations, it was suggested by Colonel Henry Flad, Principal Assistant Engineer of the Illinois & St. Louis Bridge Company, to abandon all idea of invading the river with any system of "falseworks" whatever, and to adopt the principle of suspension from above in some form. He elaborated his ideas to some extent, and made preliminary calculations, which so entirely demonstrated the practicability of his views, that I was instructed by the managers of the Keystone Bridge Company to work out the complete details of the proposed plan, in doing which I have received most valuable assistance from the mature judgment and advice of Captain Eads, Engineer of the Illinois & St. Louis Bridge Company, Colonel Henry Flad, and of Messrs. J. H. Linville, President, and J. S. Piper, General Manager of the Keystone Bridge Company.

Each arch rib is in the form of a polygonal segment, consisting of an upper and lower member, spaced 12 feet apart from center to center, each member being a series of steel tubes of 18 inches diameter and about 12 feet in length. The number of segments composing each rib are as follows: in the side spans—upper members, 42, lower members, 43; in the center span—upper members, 44, and lower members, 45.†

Accurate calculation demonstrates the ability of the ribs, when divested of the moving load and weight of roadways, platforms and their supports, to sustain themselves as cantilevers projected from their skewbacks, for a distance equal to about one-fourth the entire span (or to joints Nos. 12 and 30); the skewbacks being immovably secured to the masonry by immense bolts of steel and iron passing entirely through the piers, from skewback to skewback, and into the abutments far enough to secure adequate anchorage, by means of cast-iron washer plates built into the masonry.‡ This being the case, it will readily be perceived that if joints Nos. 12 and 30 are sustained by cables passing over a temporary tower, reared above the piers and abutments to such a height as will afford an economic angle, and with strains exerted in them to equilibrate the gravity of the semi-girders with their extraneous loads of staging, hoisting and other erecting machinery sustained by them, and also elevate joints Nos. 12 and 30 to their proper horizontal position by taking up the deflections, then the remaining quarter spans may, by repeating the process, be projected forward until they meet in the center of the span; the deflections of these last quarters of the spans must be taken up by a secondary cable system, carried from the center sections over masts erected at joints Nos. 12 and 30, and back to an anchorage to the ribs themselves near their skewbacks.

By careful calculation it is found that a strain of 216 tons in the primary and 108 tons in the secondary cables will fulfill the foregoing conditions, and sustain joints Nos. 12, 22,23 and 30 at their normal heights, the temperature being 60 deg. Fah. The two semi-ribs having thus been projected, leaving only the closing section to be inserted to complete the arch, it will be found that their ends are too near together by an amount equal to the difference between the compression in the whole arch produced by its weight and superincumbent load, and that produced by the artificial strains in the cables, the former being 3.4 inches and the latter 0.464 inches in the upper tubes, and 0.257 inches in the lower ones, leaving 1.236 inches in the upper and 1.44 inches in the lower tubes, of compression or contraction still to be accomplished in each semi-rib by some other means before the closing section can be inserted; the suggested modes of effecting this will be hereafter described.

Economical considerations induced the decision to project only the two middle ribs to a "close"—in the center of the spans by means of the cables, stopping the erection of the two outside ones at joints Nos. 12 and 30 until the completion of the two middle ones; these will afford a perfected arch of two ribs 12 feet apart, by means of which, from cantilever stages projecting laterally from them, the remaining sections of the outside ribs can conveniently be put in place.

The two outside ribs, when projected to joints Nos. 12 and 30, will be sustained by sub-cable systems attached at joints Nos. 6 and 36, to take up their deflections, so that their weight, acting through the diagonal tension rods, may not be imposed upon the middle or main cables; it is found that a strain of 130 tons on these cables will elevate joints Nos. 12 and 30 to their proper height; at the abutments they will be carried back to an artificial anchorage obtained by loading down a stage with railroad iron.

The derricks, and working stages suspended from them, will travel forward section by section as the work advances; they will be moved by rack-and-pinion gearing, and travel on movable tracks, mounted in successive sections, on the top of each rib, and secured to the upper tube by clamp-bands. There will be a crab to each of the four ribs, with booms projecting beyond the tubes, from which the machinery will be hoisted from barges anchored immediately below. The four derricks will all be connected together laterally by ties and braces, so as to act as one frame, mutually stiffening and supporting each other.*

I now proceed to describe the cable systems and accessories under the following heads:

I. The Timber Towers and Guide Trestles.
II. The Hydraulic Rams and their Balance Gauges.
III. The Cable Chains and their Anchorages.
IV. The Cable for Side Ribs.
V. The Secondary Cable System.

I. THE TIMBER TOWERS AND GUIDE TRESTLES.

The towers for each pier and abutment consist of two pyramids of timber about 50 feet in height, formed with a central post or mast of four yellow pine whole sticks, 12 inches by 12 inches, strongly framed together with oak keys and iron bolts in both directions, thus combining them into a solid post 24 inches square, footed into a suitable casting resting on cross-sills, which are of oak timber 18 inches by 24 inches; in order to preserve their full strength, these sills, at their crossing, are not "halved" together, but simply crossed and locked with an inch "lock-joint" and through bolts, the difference in the level of their under surfaces being made up of oak blocking, bolted to the under side of the upper sill; from the four extremities of the cruciform sills, four braces of yellow pine, 12 inches by 12 inches, are carried up nearly to the top of the center mast, inclining from it at an angle of 6 deg.; at their upper ends they are securely framed and bolted to the four sides of the center post, with intermediate ties and stout bracing between them and the mast, at intervals between the top and sills; the two pyramids are also connected together laterally throughout their whole length by a strong system of struts and ties, thus mutually supporting and stiffening each other. The top of each mast is surmounted with a suitable casting, forming the apex joint of the cables.

To stay or "guy" these towers in a lateral or "up-and-down-stream" direction, two guide trestles are employed, standing 12 feet apart and firmly anchored to the masonry. These trestles have sills 60 feet and caps 29 feet long, and stand 48 feet in height; they are framed of pine timber, 12 inches by 12 inches, with three vertical posts 7 feet 9 inches apart from center to center, and with two leaning posts or braces inclining to the verticals at an angle of 24 deg. The posts and braces are strongly secured to the caps and sills by heavy iron straps and bolts; they are also stiffened transversely by a strong system of clamps and braces; at the tops these two trestles are connected, by horizontal tie beams and braces, so disposed as to leave rectangular openings or "slots" through which the upper ends of the masts are free to move up and down, and in the direction of the axis of the bridge, and to resist any tendency to transverse movement.†

The cruciform sills of the towers stand on the "cross-heads" of two hydraulic jacks or rams, which are located directly under the center of the masts, the office of which is to maintain a constancy of strain in the cables, under changes induced by variation of temperature. Thus the towers standing on their two rams are free to move up and down, as the plungers move up and down in the cylinders, to compensate for the contraction or expansion in the cables and tubes induced by thermal variation. To guard against accident which might arise from the possible failure or derangement of the rams or gauges, a properly arranged "blocking" will be kept constantly under the tower sills, with gum cushions or some other suitable device interposed, so as not to interfere with the free action of the rams.

II. THE HYDRAULIC RAMS AND THEIR BALANCE GAUGES.

The cylinders of the rams are 13 inches in diameter and 30 inches in height, the metal is 7 inches thick, and there is 12 inches length of stroke provided for, though but 6½ inches is actually needed; the plungers are solid, 13 inches in diameter, and the packing is of leather, cup-shaped, in recess of cylinders near the top; the area of the plungers being 132.75 square inches, and working pressure 2,560 pounds per square inch, the working power of each ram is 170 tons, which is the calculated work required of them, being the vertical component of the cable strains plus the weight of towers, etc.; ample provision is made for additional strain that may be required, by the rams and all their gauges and connections being tested to 5,000 pounds per square inch before being put into service.

The cross-heads are disconnected from the plungers, and rest upon them, in a planed rocking-joint. Should any accident happen to the rams, requiring their temporary withdrawal or replacement, it can readily be done by introducing four smaller jacks or rams under the leaning brace-posts of the towers, by which means the main ram may be entirely released.

The gauges by which the ram pressures are to be governed and measured will be long wrought-iron hydraulic tubes, 2.284 inches in diameter, with plungers weighted with moveable "pea weights," working in them, having a stroke of 7.5 feet. The object of the long stroke is to make these gauges *automatic* governors of the strains, within a certain limited range of thermal variation, thus determined: By minute calculation of the extension and compression induced by the strains in the material of the cables and tubes, together with the effects of a range of 80 deg. each way from the normal of 60 deg. Fah., or from 20 deg. below zero to 140 deg. above, in producing expansion and contraction, we find that the apex of the cables will change its position vertically 6.5 inches in maintaining an unvarying strain within that range of thermal variation; this, then, is the total stroke of the ram, which being 13 inches in diameter gives 862.5 cubic inches of the fluid in the ram, corresponding to 140 deg. range of temperature. Now the gauge tube being 2.284 inches in diameter, 7.5 feet stroke will move 319.25 cubic inches of fluid; and as one gauge governs two rams—one half that amount, or 159.425 cubic inches, being 18.5 per cent. of 862.5 cubic inches—it follows that the stroke of the gauge controls that percentage of thermal range of the ram, or 29.6 deg. Hence within that range the gauge is "*self-acting*" in maintaining constancy of pressure. Beyond that range, the "pea," by rising and falling to the extremity of its stroke, gives notice to the person in charge of the rams that he must let off, or force in fluid, as the case may be, to again restore the "pea" to its midstroke position. Provision is make for gradually increasing the strains as the work advances, by the addition of successive weights to the "pea." When the cables are first attached at joints No. 12 and 30, the strain required is only 65.5 tons, obtained by a weight of 3,300 pounds on the gauge. This is the starting weight; after that, for each section of tube added, a weight of 100 pounds is added to the gauge, keeping, however, the strain a little in excess of that actually required to balance the weight; to give rigidity against suddenly imposed or relieved loads on the working stages, and to still further guard against vibratory action in the rams and gauges that might arise from these causes, it is proposed to interpose a diaphragm with only a small hole in it, at some point in the connections between the rams and the gauges, which, while allowing the pressure gradually to equalize itself, would [illegible] the gauges from sharing in any sudden vibrations in the rams.

III. THE CABLE CHAINS AND THEIR ANCHORAGES.

The cables will consist of wrought-iron eye-bar links, each 27 feet 6 inches long and 1 inch thick; alternately seven bars 6 inches wide and six bars 7 inches wide, thus giving a cross sectional area of 42 square inches. The heads are upset; the working strain allowed on the links is calculated at about 5 tons per square inch.

The connecting pins are 3.5 inches in diameter. At each end of each cable a set of adjusting links is introduced of 2.25 inches by 2.75 inches, with screws of equal strength and long "right-and-left" sleeve nuts or swivels for the purpose of taking up slack and bringing all the strands as nearly as possible to an equal tension before the ram pressure is applied. They are attached to the upper tubes of the arch ribs by heavy wrought-iron forged clamps, each completely encircling the tube, just in front of the joint-coupling, against which it rests.

On the St. Louis side, the anchorage is obtained by sinking vertical wells into the solid rock to a depth of from 25 to 30 feet, and then undercutting the rock to form chambers to receive heavy castings, to which the links are secured by eye-bolts. On the Illinois side, where the surface formation is entirely of sand, an artificial anchorage has to be provided, which will be done by making an excavation and driving within it four rows of sheet piling—each pile 12 inches by 12 inches—in a direction at right angles to the plane of the cables, and of sufficient breadth to [illegible] a sufficient body of sand to amply resist the pull of the cables.

Behind the sheet piling a beam is placed, built of oak timber, 12 inches by 12 inches, keyed and bolted together in both directions, so as to form a solid beam 4 feet square, and distribute the strain over the whole breadth of the sheet piling. To this beam the cables are secured by oak crossheads and wrought-iron keys, in a manner to distribute the strain over the whole breadth of the beam. After the cable attachments are made, the whole excavation will be filled up and rammed, leaving the beam buried behind its sheet piling some 30 feet below the surface.

IV. THE CABLES FOR SIDE RIBS.

As before mentioned, the side ribs will be sustained by another system of cables, in order that by their deflection they may not throw additional strain on the main cables, through the diagonal bracing rods. These cables will have a working strain of 130 tons, and a sectional area of 26 square inches they will be the same in general form and management as the main cables, being alternately three bars 7 inches by 1.25 inches, and four bars 6.5 inches by 1 inch. They will be provided with screw-adjusting links at each end, and attached the tubes with clamps in the same manner as the cables will be carried over the piers and abutments on very simple "saddle blocks." No hydraulic rams will be used with these cables, their office being simply to hold the outside ribs at the [illegible] the middle ones, which can be done with screw-adjusting links.

A convenient anchorage for the abutment end of these cables is obtained behind the center wall of the abutments, where an offset or step occurs, against which the edge of a platform can rest, with a mass of solid masonry in front of it amply sufficient to resist the "horizontal" component of the cable strain, while the "vertical" will be resisted by loading the platform down with railroad iron.

V. THE SECONDARY CABLE SYSTEM.

The details of the secondary cable system, required for elevating the middle-arch ribs at their center joints, have not yet been fully determined upon. In general, however, it will consist of masts erected at joints Nos. 12 and 30 (where the main cables are attached), with cables of link bars carried from the head of them to the joints next back of center joint, and with back-stays attached to the tubes near the skewbacks. The strain required on this cable is 110 tons; it is as yet undecided whether this will be obtained by hydraulic power or by screws.

When the middle ribs have, by the foregoing described process, been projected to the center, so that nothing remains but to fit in the closing section of tubes to complete the arch, a difficulty arises, how to surmount which is still the subject of much study.

As before mentioned, the length of the unloaded arch rib, at the normal temperature of 60 deg. Fah., is 3.4 inches longer than it will be when complete and loaded; hence the space left for the closing section at a temperature of 60 deg. will be that amount (3.4 inches) short for the tube. The problem then is how to produce such an enlargement of this space that the closing section may be inserted. A portion of this is obtained by the compression induced by the cable strains—equal on both the semi-ribs to .464 inches in the upper tubes and .257 inches in the lower tubes—leaving 2.472 inches in the upper and 2.886 inches in the lower tube still be obtained in some other way.

Should the closing of the arches happen in mid-winter, or when the temperature ranges the lowest, the difficulty is materially lessened in this way: the entire length of the arch ribs being 6.357 inches, a fall of temperature of 68 deg. below the normal 60 deg. Fah. would produce a contraction of about 2.88 inches (at the rate of .001 per 150 deg.); should, therefore, the mercury range from 8 deg. to 10 deg. below zero, the center section could be entered without difficulty. Should the temperature not range as low as that at the time it is necessary the work should be done, it has been suggested to produce the required reduction of temperature in some artificial manner, such, for instance, as passing a stream of cooled compressed air through the tubes, the air to be—by passing through an ice-box, for instance—entirely deprived of the latent caloric evolved by the compression; and then being forced through the tubes of the arch ribs, it will, while expanding in its passage, abstract caloric from the tubes, they being protected from the external atmosphere by wrappings of non-conducting material. In this way it is believed a reduction of temperature may be produced sufficient to give the desired contraction.

It is not possible to employ direct pressure to effect this object, owing to the great weight of the machinery and appliances required to produce it, which would throw inadmissible additional strains upon the tubes and supporting cables. It is possible that the ends of the semi-ribs may be sprung up sufficiently in the center to allow the center section to be entered; but this plan has not yet been fully investigated.

The order of erection will be as follows: starting simultaneously from the western abutment, and from both sides of the west pier, the four ribs will be completed to joints No. 12 and 30 in the western and center spans, and the two middle ribs completed in the western span. The towers and cables will then be transferred from the west abutment to the east pier, from which the four ribs will be carried out on both sides to joints 12 and 30, and the middle ribs closed in the center span.

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* Engineer of the contractors, the Keystone Bridge Co.

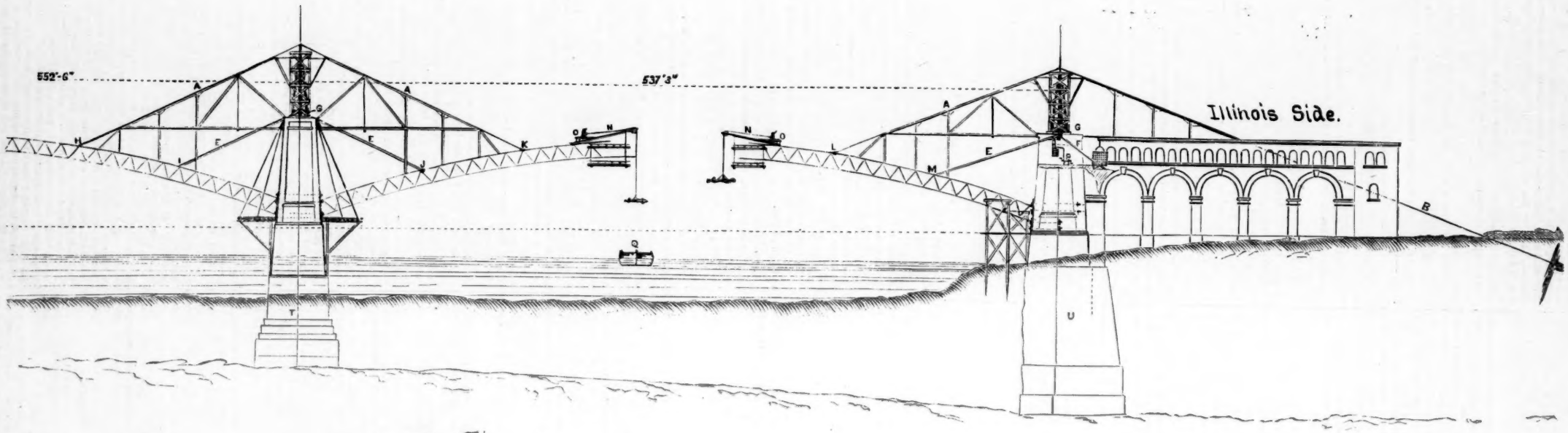
† Mr. Katte said: The middle span is 515 feet long, from center to center of skewback, and the end spans 497 feet long.

‡ Mr. Katte said: The bolts vary from 22 to 38 feet long.

‖ Mr. Katte said: We will then have the completed arch 12 feet wide over the whole span, and by stages from that the outside rib an be added.

* Mr. Katte said: One of these derricks must be attached to each tube; each is to be clamped by screw clamps, passing entirely around the tube, so that it will stand firmly upon the work itself. As one section is built, the derricks are to be moved forward.

† Mr. Katte said: In the middle section there is a tendency to sway, caused by the different expansion of the cables, so that we can move it up and down, and also move it slightly one way and another at the top. The different expansion in the cables induces a very slight motion under the changes of atmosphere.



PLAN FOR ERECTING THE SUPERSTRUCTURE FOR THE ILLINOIS & ST. LOUIS BRIDGE.

The towers and cables will then be transferred from the west pier to the east abutment, when the four ribs will be built to joint No 30 and the middle ones to the center of the east span. In the meantime the addition of the outside ribs, between joints Nos 12 and 30, will be going on simultaneously, upon stages "outrigged" from the completed middle ribs.

References to Engraving on Opposite Page.

A, A.—Main cable to inside ribs. Max. strain, 216 tons.
B, B.—Anchorage cable.
C, C.—Secondary cable to inside ribs. Maximum strain, 110 tons.
D, D.—Back stay.
E, E.—Cable to outside ribs. Maximum strain, 130 tons.
F, F.—Back stay.
G. G.—Hydraulic ram.
H.—Joint No. 32.
I.—Joint No. 38.
J.—Joint No. 36.
K.—Joint No. 30.
L.—Joint No. 12.
M.—Joint No. 6.
N, N.—Derricks and working staging.
O, O.—Crabs.
P.—Pumps.
Q.—Barge to bring material from shore.
R.—Rock anchorage.
S.—Sand anchorage.
T.—East pier.
U.—East abutment.
V.—West abutment.
W.—West pier.
X, X.—City directrix.
Y, Y.—Ordinary water line.
Z, Z, Z.—Light strutting to keep deflection out of cables and for convenience in putting them in place.
a, a.—Outside rib.
b, b.—Inside rib.
c.—Anchor well.

Contributions.

PRACTICAL FIELD ENGINEERING.

NUMBER IV.—LEVELING FOR PROFILE.

The operation called leveling is one of the simplest and at the same time the most useful of all the things required to be done by a field engineer.

To acquire a thorough knowledge of the principles of leveling should be a matter of gravest interest to every young man desiring to become a good practical engineer, and it is not sufficient for such a one to learn merely the *mode* of adjusting, setting and directing a Y level, and the manner of taking and "working up" field notes; but he must also master the theory—the principles upon which the practice of this beautiful art is based. This can be done by giving careful attention to the following explanations and observations.

The line of collimation of a Y level, when properly adjusted and leveled, is a straight line tangent to the surface of still water, if in the same horizontal plane. When a common leveling rod is held perpendicularly with its heel resting on the ground or any fixed point, the division line of the rod upon which the line of collimation of the level strikes marks the difference of level between this fixed point and the line of collimation.

A *datum line* is an imaginary line drawn parallel to the line of collimation of your level. In railroad leveling it is usual to take the *datum* 500 feet below the starting point.

A *bench-mark*, or *bench*, is usually made by cutting a notch in the buttressed root of a tree, or by smoothing a place on a stone or any other solid object not liable to be shaken or displaced.

A *bench* is usually taken as the commencement point of every leveling operation. In railroad leveling the elevation of this commencement *bench* is generally assumed to be 500 feet above the datum line.

Now, if your datum line is 500 feet below your commencement bench, the reading of your rod, held on the bench, added to five hundred feet, will give the difference between the elevation of the line of collimation of your instrument and the datum line. This difference of elevation is technically called the "*height of instrument*," and is designated in the leveler's field book by "*H. I.*"

Well, after the height of your instrument is found, if you wish to find the elevation above the datum line of any other point than your commencement bench, direct your rodman to hold his rod on the point and take the reading. Subtract this reading from your height of instrument, and it will give you the elevation of the point. For, since your height of instrument is the distance in feet of your line of collimation above your datum, and since the reading of your rod is the distance in feet of your line of collimation above the point where the rod rests on the ground, it is plain that the difference between the reading of the rod and the height of instrument expresses the elevation of the point where the heel of the rod rests and the datum line.

A level-book is best kept as follows:

Station.	*Back sight.*	*Height of Instrument.*	*Fore-sight*	*Rod*	*Elevation.*
Bench.		506.00		6.00	500.00
0				5.00	501.00
1				7.20	498.80
2				6.40	499.60
Peg.	6.20	505.18	7.12		498.88
3				4.20	500.98
4				4.00	501.18
+80				3.00	502.18

We may now easily explain the whole operation of leveling a railroad line. Suppose, as in the above example of field-notes, you commence on a bench 500 feet above your datum. Enter "bench" in your column of stations and set down 500 in your column of elevations. Have the rod held on the bench and take the reading, which in this case is 6 feet, and set it down in the column headed *rod*. Now 6 added to 500 gives 506 as the height of instrument, which is placed in the column so marked. Now have the rod held at station 0 and set the reading in the *rod* column. In this case the line of collimation strikes the rod 5 feet above the ground. Then 5 feet from 506 feet gives 501 feet to be placed in the column of elevations, and so on.

In the case under consideration, when you have taken the rod reading at stations 0, 1 and 2, you wish to go forward with your instrument for a new set. To do this have your rodman drive a small stake into the ground until it stands firmly. Now take a reading of the rod held on the top of this peg, or stake, and work up the elevation as already explained by subtracting the reading from the height of instrument and place result in the column of elevations. The reading of the rod held on the peg is placed in the column marked foresights. Now pick up your level and carry it as far beyond the peg as you wish to go, say three or four stations; set it firmly and level it. Now take another reading of the rod held on the peg and enter it in the column of back-sights. In this case the reading is 6.30. Now add this back-sight to the elevation of the peg and you have the height of your instrument, at this second setting, which must be entered in the proper column. You are now ready to proceed as before in taking readings at the stations and working up the elevations by subtracting each reading from the height of instrument.

The stations of a railroad survey are generally one hundred feet apart. If the leveler finds marked depressions or elevations in the ground surface between the stations, he must take what is called a *plus reading*. That is, he must have the rodman measure the distance from the station last leveled to the depression or elevation, and there take a reading and work up the elevation. In the present case this distance is 80 feet, and is marked in the column of stations + 80. These plus readings are of great importance, particularly in a rough country, and the young engineer must not neglect to take them as often as the nature of the surface requires. To expedite work the rodman soould be instructed to measure off these *plus* distances and call them out as he sets up his rod (+ 80, + 50, + 30) "plus 80," "plus 50," "plus 30," as the case may be.

The best rod for general use in railroad leveling is made of light wood, 12 feet long, 2 inches wide, three-fourths of an inch thick and graduated to feet, tenths and hundredths of a foot. The divisions to feet and tenths should be numbered in figures large and plain enough to be read by the leveler through his instrument at the distance of five hundred feet. The target or vane of this kind of rod has a vernier attachment, by means of which a reading may be taken to thousandths of a foot.

In taking the levels of the ground surface the readings should be feet and tenths, which is near enough for any practical purpose; but when the rod is held on a peg or a bench, the reading should be feet and hundredths.

The elevation of each bench should be marked on the tree, stone, or other object chosen, in red keel.

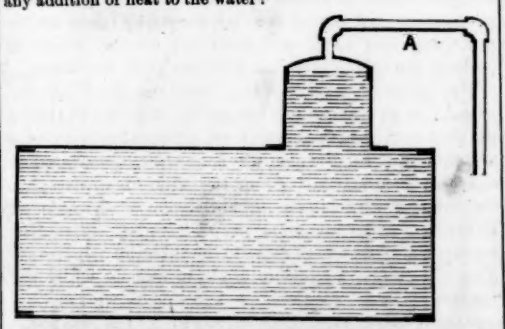
The rodman should keep what is called a "Peg Book," in which he puts down the fore-sights and back-sights at each peg and bench, the height of instrument, and the elevation of pegs and benches. His work operates as a check on that of the leveler, if the books are compared at each setting, thus preventing dangerous mistakes.

Fireless Locomotives.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I notice in some of the papers that patents have recently been taken out for a locomotive the motive power of which is to be derived from a supply of hot water, which is heated in stationary boilers and then transferred to the locomotive. It is supposed that the heat contained in this water will be sufficient to supply the engines with steam for a run of a number of miles, without the use of any fire in the locomotive.

Can you or any of your readers inform me how much water heated to a temperature due to steam of say 150 lbs. (above atmospheric) pressure per square inch, which is equal to about 366 deg., can be drawn from the boiler in the form of steam, and at what pressure, supposing there is no loss from radiation or any addition of heat to the water?



In order to make my meaning perfectly clear, I send the above sketch, which represents a boiler 4 feet in diameter by 10 feet long, with a dome 2ft. x 2ft. Such a boiler will have a capacity of 132 cubic feet of water. Suppose now it is filled with that quantity, heated to a temperature of 366 deg., how much of it could be utilized in supplying steam to an engine, if a pipe, *A*, was attached to the dome, and what would be the pressure, supposing, as I stated before, that there is no loss from radiation.

PRACTICAL ENGINEER.

A Locomotive Problem.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Some of the "boys" on the P. P. & X. R. R. have made a bet in regard to the amount of weight there would be on the driving-wheels of locomotive No. 26 with Bill S—— and his fireman on the foot-board. He is the heaviest man on the road and weighs 221 lbs. His fireman weighs 179, so that together they weigh 400 lbs. Engine 26 has 36,452 lbs. weight on the driving-wheels, in working order, without the engineer and fireman. She is a common style of eight-wheeled engine, and measures 7 feet 9 inches from center to center of driving-wheels, and 10 feet 9 inches from center of front driver to center of truck. If any of your correspondents can tell us how much more adhesion No. 26 has with her corps of operatives on board than she has without, they will oblige

ONE OF THE "BOYS."

[We will be glad to receive communications from correspondents with reference to the above inquiries, which are submitted to our readers.—EDITOR RAILROAD GAZETTE.]

Cost of Working Narrow-Gauge Railroads.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Having taken much interest in all articles relating to "narrow-gauge railroads," having had charge of a preliminary survey for one over 100 miles long, over a moderately broken country, and examined the maps and profiles of a located line 25 miles in length, both in the State of Georgia, and having calculated and compared estimates, etc., I could not find the great economy claimed by the advocates of the system.

In the line as surveyed I did not expect to use curves of less than 6 deg., or 955 feet radius; in fact, I do not think that at any point it would have been necessary or desirable, although on other roads (broad gauge) where I have been engaged we used freely 400 feet radius (see Baltimore & Ohio). My estimates were: a saving of about 10 per cent in graduation; and I found that by proper *adjustment of grades*, according to the direction of the grade, a much larger saving could be made.

I have diverged from the point or questions I wished, viz.: Will not a broad-gauge box car of same floor space weigh less than one of narrow gauge? Say for the narrow gauge 20 feet long by 6 feet wide = 120 square feet floor, with 52 feet of end and siding; whereas in the common gauge 14 feet long by 8½ feet makes the same floor room, with only 45 feet of end and siding, and as the floor timbers are so much shorter, they may be decreased in size. Will not these two points more than compensate for the increased weight of axle?

Why is it that the cost of transportation on the celebrated Festiniog Railway is so high? Mr. Spooner reports the cost of mileage of his trains at 4 6-10 shillings, while that of the four English roads he quotes is only 2 80-100 shillings, or, counting the profits the same on both passenger and freight, with the pound at $5.50 currency, why does it cost 35 cents per ton to transport slate 13 miles on the Festiniog Railway when it costs only 80 cents to transport coal on the Reading Railroad 98 miles? We all know that the cost of transportation on English roads, on account of low price of fuel, labor and material, together with their better graded roads, is much lower than with us, and to make a plain comparison we should add at least 50 per cent. to the cost on the Festiniog, making it 52 cents per ton for 13 miles against 80 cents per ton for 98 miles. Where, then, is the great economy of transportation they claim?

These two points I have never seen held up by opponents of narrow gauges.

Personally I am not particularly partial to any gauge, but believe in the doctrine of *building* and *stocking* a road in view of the business it will probably control and its connections. We want cheap roads in construction and working. D. H. K.

Steam Excavators—Information Wanted.

SEPTEMBER 5, 1872.

TO THE EDITOR OF THE RAILROAD GAZETTE.

Can you give me some information about steam excavators? Who make them, what do they cost, and how many cubic yards of average gravel will they move per hour? I think there are two patterns, one by Osgood and one by Otis. Which is the best? N.

[We frequently receive inquiries similar to the above, but are not able to answer them. If manufacturers of excavators and steam shovels will supply us with illustrations and descriptions of their machines, they will be doing us and our correspondents a favor and themselves an advantage.—EDITOR RAILROAD GAZETTE.]

Prices of Rails in August.

Bigelow & Johnston, of No. 48 Pine street, New York, report as follows the prices current of rails for the month of August:

	Gold.	Currency.	Import, Tons
New Rails.			
English	$75 @ 76		28,674
American		$85 @ 90	
Total import this month.			28,674
Import since January 1			100,319
Total to date			128,993
Same time 1871			115,891
Old Rails.			
Double heads	$52 @ 52½		
T or Flange	$51½ @ 52		
U or Bridge	Nominal.		11,136
Total import this month.			11,136
Import since January 1.			31,747
Total to date			42,873
Same time 1871			26,560

New Rails. Although the market, during the month, has been very firm and prices have advanced, yet the business accomplished has not been great, and the continued quietness is the subject of general complaint. American mills are generally pretty fully occupied, but not at very remunerative prices, taking into consideration the price of material. Our imports this month consisted largely of Bessemer steel rails, the use of which is steadily increasing.

Old Rails. Rather a dull, dragging trade, and prices somewhat weak. Arrivals have been free, and stocks are accumulating.

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Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the railroad public in affording us the material for a thorough and worthy railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Inventions.—No charge is made for publishing descriptions of what we consider important and interesting improvements in railroad machinery, rolling stock, etc.; but when engravings are necessary the inventor must supply them.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

THE "PRACTICAL MAN."

On another page will be found an extract from the opening address before the section of the British Association devoted to Mechanical Science. A portion of what we have reprinted is devoted to setting forth the short-comings of the so-called "practical man." Now, if these remarks were directed against the men who are "practical" in the true sense of the word, it would be utter folly to give them attention. The term has, however, been so misused, and inefficiency, ignorance and worse have hid so much behind it, that it begins to have a signification quite different from that which the meaning of the word itself would indicate. For example, the man who builds bridges and proportions the parts "by his eye," and who is unable to calculate the strains in a single member; mechanics who do not know that two ⅞-inch rivets are weaker than a rod 1¼ inches in diameter, and who attribute boiler explosions to "electricity;" and those who seldom disburse money for their employers without placing their hands behind their backs with the palms upward in a slightly concave form, and at the same time give their fingers a vibratory movement, all assume the character of "practical men." Now, neither Mr. Bramwell before the British Association nor the writer means to convey the idea that there is any degree of moral or mental obliquity about truly practical men who have no theoretical knowledge. The thing which he found fault with, and in which we agree with him, is the kind of man who never believes in anything outside of the scope of his own observation or experience. He is a man whom St. Paul would have described as without any belief in "the *substance* of things hoped for," or "the *evidence* of things not seen." It is not that such men refuse to place confidence in the representations of mere visionary schemers; it is that they are incredulous about the "substance," or actual thing, which is amply supported by "evidence." They are incapable of any exercise of faith, which is based upon intellectual reasoning alone, and will place no confidence in that which is supported by the most logical deductions. Any attempt to convince such men of the value of any discovery or invention which is somewhat outside their ordinary habits of thought is like offering pearls to swine. Such men regard all reasoning which leads to conclusions different from their own as a mere deceptive artifice employed by an enemy for their detriment; and when by such means they are shown to be mistaken or wrong, they feel that they have been injured unjustly. If such a man builds a bridge, if it breaks down and it is shown mathematically that some parts were not strong enough to stand the strain to which they were subjected, he is sure that there is a conspiracy against him; or, if he is a master mechanic, and you suggest to him that his engines would burn less coal if he protected their cylinders and boiler better from radiation, he will be apt to tell you, in terms more forcible than elegant, that you would better mind your own business. If he is a car-builder, and you tell him that his cars are odoriferous for the want of ventilation; and you explain to him that each person requires a certain amount of fresh air, in a given time, and that provision should be—but usually is not—made for supplying it, such a man will be very apt to say some very uncivil things to you, and end with an uncomplimentary rebuke for attempting to instruct a "practical man." It is curious how this subject of ventilation will call out the animosity of such men, chiefly because it is of a somewhat intangible character. At the present time fresh air is a *substance* which travelers are obliged to hope for a great deal, and the vile odors of unventilated cars are the "*evidence* of things not seen."

If any one wishes to test our assertions by experiment, let him try the following syllogism on a car-builder who belongs to the class of "practical men." First, start with the assertion that each person requires so many cubic feet of air per minute, and therefore fifty people require fifty times as much; consequently every passenger car should be provided with the means of supplying so much air to the occupants. After having made this clear to your hearer, prepare to leave, as the conversation will in all probability not be agreeable thereafter.

Now, in order to understand the *animus* of the "practical man," let us examine what to an inhabitant of some other sphere must seem like a very absurd characteristic of human nature, that is the pride of opinion, of which, if we are honest, we must all see the elements in our own characters. Nearly all men have at least a half-conscious feeling that in some directions, or regarding some special subjects, their knowledge is better than that of any one else. Doctors say that most patients are gratified at being told that their maladies are different from those of other people and present some remarkable symptoms. The vanity of self-educated people is also often remarked. Most of us know how much the estimate we place upon our own knowledge is depreciated by a conversation with a person who has more and better information about things which we thought we knew very well, or possibly better than other people. The same thing occurs when we investigate some subject in books, and find that what we knew and thought has been known and recorded long before, besides much that we never dreamed of. Now, for the ordinary quality of human nature, such comparisons are necessary all through life, to prevent the inordinate growth of the pride of opinion. To avoid this, we must constantly compare our own knowledge with that of others. Nothing will do this so effectually as the constant habit of reading. Now the "practical man" is not a reading man; he therefore does not in that way compare what he knows with what other people know, nor become accustomed to being taught by books and to practicing that habit of intellectual docility which is perhaps one of the most valuable results of education.

The habits of thought of the "practical man" are also revealed to us somewhat if we reflect a little and realize the feeling of possession which we all have for those ideas and that knowledge which we have either discovered or eliminated ourselves. From the time of Christopher Columbus down to these days of denial of the right of an inventor to his invention, people have felt that the discoverer has some sort of right to the thing he discovered. Now if we reflect a moment on the manner in which the "practical man" acquires his knowledge, we must observe that nearly everything comes to him as the result of observation, or to some extent of discovery. He knows no other teacher than experience, and he intuitively feels that his knowledge is in some sense peculiarly his own, and human nature concludes the inference that, therefore, it is better than any other knowledge. The same idea is expressed in the common phrase that such or such a person thinks "what they don't know is not worth knowing."

The conduct of the "practical man" indicates that not only does he often believe that he is the discoverer of what he knows, but that in some sense he *caused* what he knows to exist. He often acts as though he had a patent on the "combination" of *knowledge with himself*, and that some "new and useful result" was accomplished by the combination which otherwise would have been impossible.

The radical fault with the practical man is, that he has no faith in the reality of merely intellectual ideas not yet put into practice. He will not believe that there is any "substance" in things hoped for, and he is almost without capacity for weighing "evidence" upon which such substance rests.

Now we are, of course, not ignorant of the immense army of impracticable, deluded and deluding, and visionary schemers who chase shadows without substance, and cannot discriminate between their own vagaries and those things which are supported by ample testimony. Railroad managers are haunted by such men, until the patience of many has become so exhausted that it is hard to get a hearing from them about any new thing whatsoever. We by no means intend to recommend this class of visionaries to the consideration of our readers, nor do we for a moment intend to condemn the truly practical man, but have only attempted to show what a hollow humbug many of the men are who arrogate the term to themselves, and who sneer at all theoretical knowledge of which they are ignorant. The man who is not practical is ordinarily not very useful. What we are contending for is, that the highest type of practical man will also have and exercise a large amount of theoretical knowledge. He who is devoid of the faculty of logical sequence and incapable of following a train of reasoning is not and cannot be a safe or wise adviser, or superintendent to conduct extensive and costly works. Such men should be capable of seeing the reasons of things and of weighing the evidence either for or against any given cause of action or conduct, as fairly and as unerringly as a judge in court. In the management of engineering or railroad operations, it is often quite possible to draw deductions with almost absolute certainty from the evidence presented, if the person who examined it is capable of comprehending and of estimating it at its proper value, and then drawing sound deductions therefrom whereas a person of less intelligence and discernment would only find confusion and perplexity under the same circumstances.

Because a man has any considerable amount of theoretical knowledge, it by no means follows that he will assumes great risks and be an unsafe man. That there are many theorists who are dangerous advisers is quite true, and many such seem to be in a state of hopeless confusion and error regarding the duties of engineers, and those in charge of engineering projects. There are many such who seem to think that every work of that kind is an occasion for experiment, sometimes with and sometimes without any special practical result in view. That capitalists investing their money in such projects should object to such a view is not to be wondered at. An engineer is usually appointed by them to accomplish some very definite object, in the most certain way. His aim must be to take the least risk possible. What we are contending for is, that an engineer who is thoroughly educated in the theory and practice of his profession is a safer adviser to conduct and superintend work than the merely "practical man," who has no intellectual training and little mental discipline.

Many quite honest men seem to have the belief that it is impossible for a person who is thoroughly educated in the knowledge which can be learned from books ever to acquire that practical experience which the doing of things gives; and therefore we know from our own observation that in many places, but especially on railroads, the fact of a young man's having a liberal education is an obstacle in the way of his early advancement, instead of a help. This condition of things, we believe, is almost entirely attributable to the influence of the so-called "practical man."

It is quite true that a young man fresh from a technical school is not a safe person to place in charge of an important railroad, although he may have all the sciences at his command and be learned in many other ways. But give that kind of man a half dozen years of experience to enable him to learn how to apply his much better disciplined habits of thought, and he will be a much more practical man than one who has spent more time in his profession, but is ignorant of all science excepting "addition, division and silence."

What railroad managers do not seem to have realized thus far is that education, as well as blood, will tell. To deny either is to set at nought both experience and physiology. There are roads that we know of in which the influence of the character of an intelligent and cultivated superintendent is felt on the whole body of operators; and on others we could name, the chief officers of which belong to this class of "practical men," on which a spirit of Philistinism prevails, both up and down, through every grade of employee.

We would be the last to place any real obstacle in the way of aspiring and deserving young men who are ambitious and worthy of advancement. But is it not possible that in our American propensity to make no disting-

tion that men in authority may be doing themselves and others an injustice, in showing an entire disregard of birth and breeding. A railroad president who, if he bought a horse, would be very particular about his blood, will appoint a superintendent or engineer of his road entirely regardless of his early antecedents or connections. That this subject is beginning to receive the attention which it deserves from scientific men is indicated by the following extract from a letter written by Mr. John Stuart Mill, and read before the British Association:

"When states of mind is no respects innate or instructive have been frequently repeated, the mind acquires, as is proved by the power of habit, a greatly increasing facility of passing into those states; and this increased facility must be owing to some change of a physical character in the organic action of the brain. There is also considerable evidence that such acquired facilities of passing into certain modes of cerebral action can in many cases be transmitted, more or less completely, by inheritance."

It seems probable, then, that a person whose parents were in the habit of "repeating" the state of mind in which persons get who take what don't belong to them, might inherit a "facility" for passing into the same state; or, if they were in the habit of practicing common sense in their ordinary daily life, the same peculiarity would probably be transmitted. At any rate, few boys or young men can pass through the course of any good school or college with credit to themselves if there is any marked mental or moral defect. Their subsequent life is, of course, another matter; what we wish to impress is that the attainments, past career and connections should weigh for more in the appointment of railroad managers than they ordinarily receive; and we believe that were some consideration given to such general characteristics, those who were thus appointed would in the end make much better practical men than the other kind we have been writing about.

Train Accidents in August.

At five o'clock on the morning of the 1st a west-bound passenger train on the Kansas Pacific Railway was thrown from the track by the spreading of the rails between Ogden and Manhattan, Kan. The engine, baggage car and two passenger cars rolled down the bank, about 12 feet high, and the passenger cars were broken to pieces. One passenger was killed and two injured.

On the morning of the 5th a west-bound express train on the Pacific Railroad of Missouri ran into some cattle about three miles south of Leavenworth, and the engine, tender and baggage car were thrown from the track. No one was hurt.

On the 11th an express train on the St. Louis, Kansas City & Northern Railway ran through a misplaced switch at Dardenne, Mo., and engine, baggage car and smoking car were thrown from the track. The fireman was fatally scalded and the engineman slightly hurt. A report says:

"Through the carelessness of the switch-tender the switch had been left unlocked, and previous trains during the night had jostled the rails of the switch out of line, so that the flange of the engine wheels struck the middle of the movable rail, causing the engine, baggage, express and smoking cars to run off the track and the engine to upset."

On the night of the 12th a north-bound freight train on the Missouri River, Fort Scott & Gulf Railroad ran into the end of a loaded car which had been side-tracked at Pleasonton, Kan., but had run down the side track till the end of it was on the main track. The car was thrown forward about 30 feet, the engine was somewhat damaged, and half-a-dozen rails were twisted up, but no one was hurt. It is reported that the car had been left with brakes down and a crowbar under the wheels.

At four o'clock on the morning of the 12th a locomotive ran through an open switch on the Toledo, Wabash & Western Railway, in Fort Wayne, Ind., with a baggage and passenger car. The locomotive was badly wrecked. No one was hurt at all seriously.

On the 12th a log train on the Florida Railroad broke through a culvert 21 miles from Fernandina, wrecking 17 cars. No one was hurt.

On the morning of the 13th a freight train on the Dayton & Michigan Railroad broke in two while going down a grade near Wapakoneta, O. After reaching the bottom of the grade, the forward part slacked speed and was struck by the rear section. The conductor and another person were fatally injured.

On the morning of the 13th, as a north-bound freight train on the West Jersey Railroad was between Wenonah and Woodbury, N. J., the right parallel rod of the locomotive broke, knocked the cab nearly loose, broke a hole into the boiler, and caused the fireman to jump off, by which he was dangerously injured.

On the 13th an east-bound mail train on the Rutland Railroad was thrown from the track by the breaking of the journal of a tender near Bartonville, Vt., and the tender, baggage car and one Pullman car were badly broken up. No one was hurt

On the afternoon of the 13th, by a reported "defect in the switch," the engine and baggage car of a passenger train on the Portland & Ogdensburg Railroad was thrown from the track near South Windham, Maine, tearing up the road for about 100 feet. The engine dug a hole almost deep enough to bury itself in. No one was hurt.

On the morning of the 14th an east-bound mail train on the Pacific Railroad of Missouri ran off the track near Independence, Mo., delaying west-bound trains ten hours. No one is reported hurt and no cause is assigned for the derailment.

On the 14th, about dusk, an east-bound stock train on the Kansas Pacific Railway ran into a herd of buffaloes about 75 miles east of Denver, turning over the engine and ditching six cars of stock. No one was hurt. The engineman was discharged for running too fast.

On the 14th two freight trains of the Chicago, Rock Island & Pacific Railroad met in collision near Joliet, Ill., damaging rolling stock badly, but hurting no one.

On the evening of the 14th a mail train on the Kansas City, St. Joseph and Council Bluffs Railroad ran into a pay car which was standing on the track at East Nebraska City, Mo., damaging both car and engine, and very slightly hurting a clerk in the mail car. It is reported that the engineman of the mail train applied the air-brake in time, but for some reason it would not work.

On the 16th two freight trains on the New York Central & Hudson River Railroad met in collision in the western part of the City of Rochester. The locomotives and some cars were considerably damaged. A misplaced switch was the cause.

On the night of the 16th the baggage and passenger cars of a train on the Queen Anne Railroad broke loose near Morris Station, on the Townsend Branch. The train was stopped, and while the engineman was recoupling, the Kent train ran into the rear, almost destroying both passenger and baggage car, and seriously damaging the locomotive. There were 18 or 20 passengers in the car, none of whom were seriously hurt.

On the afternoon of the 16th a north-bound passenger train on the Delaware, Lackawanna & Western Railway was completely wrecked near Stroudsburg, Pa., and the fireman, baggageman and brakeman were dangerously hurt.

On the evening of the 16th a freight train on the Galena Division of the Chicago & Northwestern Railway broke in two, between Rockford and Winnebago. It was on a down grade, and both sections kept moving; but when it was discovered, they were some distance apart, and the engineman stopped and was preparing to back up, when the rear section came running around a curve and into the forward section, injuring one person on the train quite badly.

On the evening of the 16th an east-bound express train on the Albany & Susquehanna Railroad was wrecked by the giving way of a bridge, about two miles north of Binghamton, N. Y., that had been undermined by recent floods. A brakeman was fatally crushed between two cars, and the engineer, fireman and baggage-master were slightly hurt. Engine, tender, baggage car and passenger car were considerably damaged.

On the 17th a freight train on the Louisville, New Albany & Chicago Railroad ran off the track two miles from New Albany, Ind., and over the ties nearly half a mile before it was checked. A brakeman was killed. The cause of the accident was a broken rail.

On the night of the 17th a west-bound freight train on the Hannibal & Naples Division of the Toledo, Wabash & Western Railway ran into some cattle at a trestle bridge near New Salem, Pike County, Ill., by which the engine and four cars were thrown from the track, and the engineman and fireman severely and perhaps fatally injured.

Early on the morning of the 19th a train conveying a circus over the Cincinnati, Sandusky & Cleveland Railroad ran over a horse near Tiffin, O., throwing some of the cars from the track, injurying four of the circus men seriously and a brakeman fatally, and greatly damaging the circus property.

On the night of the 17th an express train ran off the track of the Wisconsin Division of the Chicago & Northwestern Railway near Sharon, Wis., and the engine was badly wrecked and the baggage car somewhat injured. The engineman was slightly and the fireman more severely injured. The Miller platform, which has but recently been adopted on this road, is said to have prevented the breaking up of the passenger cars.

At 4 o'clock on the morning of the 18th two freight trains met in collision on the Toledo, Peoria & Warsaw Railway at Chatsworth, Ill., and an engine and five cars were ditched and badly damaged.

On the 18th an engine on the Mobile & Ohio Railroad at Artesia, Ala., having been backed down to wood up, and the engineer having left it, the fireman suddenly started the engine, jumped off and ran away. It had attained a speed of 15 miles an hour when it ran into the rear of a passenger train which was standing on the track while the passengers were at breakfast, wrecking two cars. The fireman was arrested.

On the morning of the 19th four mail cars of the north-bound Washington train on the New York Division of the Pennsylvania Railroad were thrown from the track by a misplaced switch opposite Trenton Barracks, N. J. No further injury was done than the damage to the cars and blocking of the track for four hours.

On the morning of the 19th a passenger train on the Framingham & Lowell Railroad ran into a wood train that was standing on the track near Acton, Mass. A flagman had been sent back by the wood train, but not in time to stop the following passenger train, though its speed was checked. Four passengers were slightly hurt, and there was very little injury to the rolling stock.

On the afternoon of the 19th as some employees of the Indianapolis, Cincinnati & Lafayette Railroad were making a trial trip with a new locomotive near Cincinnati, they backed it at a high rate of speed into the head of a freight train. The freight engine went through the new tender, a caboose car telescoped with the freight tender. Two men on the new engine were badly hurt. The Cincinnati *Star* says: "The accident was wholly due to the forgetfulness of those in charge of the Rogers engine, as she was running at a high rate of speed upon the freight train's time, and those in charge of this engine seemed to be totally oblivious of everything but her working."

On the morning of the 20th an east-bound freight train on the Chicago & Iowa Railroad met in collision a west-bound passenger train. Both trains were running slowly, and no one was hurt and little damage was done.

On the 20th there was a collision of two trains at the crossing of the Atchison Branch of the Chicago & Southwestern and the Kansas City, St. Joseph & Council Bluffs roads. Both engines were badly wrecked.

On the 20th two cars of a freight train on the Pacific Railroad of Missouri ran off the track and into the ditch just below Atchison, Kan.

On the afternoon of the 21st the boiler of a locomotive on the Atlantic & Gulf Railroad exploded about ten miles from Savannah, Ga. The engineman and fireman were scalded, and a man standing by the track was fatally hurt.

On the 22d a train ran off the track of the new Houghton & Ontonagon Railroad near L'Anse, Mich., injuring two employees of the road.

On the morning of the 23d nine cars of a freight train were thrown from the track of the Illinois Central Railroad near Ashkum, Illinois, blocking the road for some time.

On the morning of the 23d there was a collision on the Toledo, Peoria & Warsaw Railway near La Harpe, delaying trains seriously.

On the morning of the 23d a passenger train on the new Chicago, Clinton & Dubuque Railroad Company was thrown from the track five miles below Bellevue, Iowa, by a plank which some wretch had laid across the track and weighted down with rocks. The obstruction was discovered at a little distance, when the train was being pushed at a speed of about 12 miles per hour. This speed was reduced to about five miles per hour when the cars were thrown off. Two cars left the track, and three passengers were killed and three injured.

On the 24th an engine and three cars were thrown from the track of the St. Joseph & Denver City Railroad near Coal Creek Station, caused, it is said, by a spike which some one had laid upon a rail. No one was hurt.

On the afternoon of the 24th a coal train ran off the track of the Baltimore & Ohio Railroad 19 miles from Baltimore, killing the engineman and badly wrecking the train. The breaking of a flange of a driving wheel is assigned as the cause.

On the 24th the engine of a passenger train on the Cumberland & Pennsylvania Railroad was thrown from the track and overturned near Frostburg, Md.; severely scalding the engineman. The road was obstructed some hours and coal shipments seriously obstructed.

On the morning of the 26th an extra freight train on the Pacific Railroad of Missouri ran into the rear of the regular freight ahead of it. The engine was somewhat damaged and the engineman's hand was crushed.

On the morning of the 26th two cars of a freight train on the Dutchess & Columbia Railroad were thrown from the track near Mattewan, N. Y., and fell down an embankment and into a mill-race. No one was hurt. There was an engine pushing the train. The cause of the accident is reported to have been a split rail.

On the afternoon of the 26th, as a passenger train on the St. Paul & Pacific Railroad was running from Minneapolis to St. Paul, a guy rope hanging from a bridge being constructed on the road caught on the first car, and the whole bridge was pulled down upon the second car, damaging the car somewhat, but hurting no one.

At 2 o'clock on the morning of the 27th, as a New York freight train was passing over the bridge over the Reading Railroad in Philadelphia, on the line of the Junction Railroad (which connects the Pennsylvania Railroad with its New Jersey Division), the bridge gave way when about half the train had passed over, the fifteenth car having left the track, struck the end of the bridge, and knocked it off from the abutment. The rest of the train fell through the bridge and upon the Reading track, just as a train of 90 loaded coal cars came down the road. This train struck the fallen cars with tremendous force, and twelve of its cars were thrown from the track and ten completely wrecked. The wrecks caught fire, and the cars, the locomotive of the Reading train, and the valuable cargo of merchandise of the New York train were consumed. The loss is estimated at $250,000. No one was hurt.

On the 27th, on the Kansas Pacific Railway, a freight train ran into another freight train, which was standing on the main track and waiting for this approaching train, doing much damage to rolling stock and blocking the road for some hours. It is reported that the engineman of the approaching train was asleep and the crew of the standing train absent from their posts.

On the morning of the 28th an express train on the Maine Central Railroad encountered a broken rail at Carmel, Me., 15 miles from Bangor. The engine, tender, baggage car and express car passed safely, but a day passenger car and two Pullman cars were thrown off. No one was hurt.

On the evening of the 28th a mixed train on the Jacksonville Northwestern & Southeastern Railroad ran into a car which the wind had blown from a side track to the main track, and the engine and four cars went into the ditch. No one was hurt.

On the morning of the 28th the tender, express and baggage cars of a passenger train on the Galveston, Houston & Henderson Railroad were thrown from the track about nine miles above Galveston, Texas, by running over a cow. The engine and passenger cars kept the track. A man in the express car was severely injured. It is reported that the engineman saw the cow on the track, whistled and slacked speed until she got off, and had fairly got under way when she jumped on again.

About daylight, August 29, a freight train on the Chicago, Burlington & Quincy Railroad broke in two near Colmar Station, Ill. The rear section afterward ran down a grade into the forward section, injurying more or less about half the cars in the train, and causing a delay of seven or eight hours. The conductor, who was standing on the platform, was badly bruised.

On the 29th a wheel under a sleeping car of an express train on the Boston & Albany Railroad was broken near Chester, Mass., while the train was running at full speed. The truck was broken so that the forward end of the car was let down upon the track, and in this condition the car slid half a mile down grade before it could be stopped. The passengers were thrown violently into the forward end of the car, but none were hurt much.

On the 29th two trains on the Baltimore & Ohio Railroad came into collision near Newburg, W. Va., blocking the road for some time, but hurting no one.

On the 30th a freight train on the Chicago, Rock Island & Pacific Railroad ran off the track between South Amana and Homestead, Iowa, wrecking ten cars and severely injuring two train men. The accident was caused by the washing away of the road-bed by recent heavy rains.

About 1 o'clock on the morning of the 30th the express train from Cincinnati to Louisville, on the Louisville, Cincinnati & Lexington Railroad was thrown from the track near Verona, Ky., by a misplaced rail, which had apparently been moved with malicious intent. The engine, tender and three cars rolled down a bank 45 feet high, and the fireman was killed and the baggageman badly hurt.

On the evening of the 30th, on the Boston, Clinton & Fitchburg Railroad, the engine of a gravel train ran into a freight train, killing the conductor of the latter.

Here we have the very large number of 53 accidents to trains, causing the death of 14 and the more or less serious injury of 39 persons. We tabulate these accidents as to their nature or cause as follows :

Derailment.	
By spreading of track	1
By misplaced switches	3
By cattle	6
By spreading of rails	1
By malicious obstruction	2
By misplaced rail (malice)	1
By washing away of road-bed	1
By breaking of tender journal	1
By defective switch	1
By broken rail	2
By broken driving-wheel flange	1
By broken car-wheel	1
By defective rail	1
Unassigned causes	7—29
Collisions.	
Rear collisions	11
Head collisions	7
Crossing collisions	1
Unknown	1—20
Broken bridges or culverts	3
Broken connecting rod	1
Total	53

A more notable fact than the large number of accidents is, perhaps, the comparatively small number of persons killed and injured. Several accidents of a very serious nature, making sad havoc with rolling stock, have been comparatively innocuous, so far as persons are concerned. By the eleven car collisions two persons were killed and seven injured; and by the seven head collisions no one was killed and only two were injured. The failure of three bridges caused the death of one and the wounding of three. Four misplaced switches killed one and injured one. Malicious obstructions were the cause of the death of three and the injury of as many.

It is seen that nearly all the accidents are classed with derailments and collisions. Derailment, however, is not a classification on account of cause. Nearly all accidents, except collisions, cause derailment; and we have tried to classify these accidents in such a way as to indicate their causes so far as possible. It will be seen that eight of them were caused by a failure of rails or other defect in the track, and three by breakage in rolling stock. Misplaced switches caused four accidents —one a collision, the other, as usual, derailment. Three or four of the collisions are directly traceable to carelessness or disobedience.

For the seven months ending with August our record is as follows.:

	No. of Accidents.	Killed.	Injured.
February	21	18	128
March	27	3	67
April	22	13	32
May	27	9	33
June	44	63	114
July	31	35	66
August	53	14	39
Totals	225	155	479

Thus August is seen to have much the largest number of accidents, and two-thirds more than the average number. The fatalities, however, are but two-fifths of those in July and two-ninths of those in June, and less than two-thirds of the average. The number injured but not killed is less than two-thirds of the average.

Record of Track Increase.

We noticed last week (when this record was accidentally omitted) new track on various railroads as follows :

Quincy, Missouri & Pacific, extended from Edina, Mo., westward to Kirksville, 21 miles. *Chicago, Dubuque & Minnesota*, extended from Albin, Iowa, northward to a point 1½ miles above Brownsville, Minnesota, a distance of 16 miles. *Chicago, Dubuque & Minnesota—Turkey Valley Branch*, track laid from the junction with the main line at the mouth of the Turkey River westward to Elkport, Clayton County, Iowa, 14 miles. *Ripley Railroad* (narrow-gauge), completed and opened for traffic from Ripley, Tippah County, Miss., north 25 miles to Middleton, on the Memphis & Charleston Railroad. *Ashtabula, Youngstown & Pittsburgh*, first section of track laid, from Jefferson, the junction with Ashtabula & Jamestown Railroad 11 miles south of Ashtabula, southward 9 miles to New Lyme. *Lake Shore & Tuscarwas Valley*, northern section, from Grafton, O., to Lake Erie at the mouth of Black River, a distance of 20 miles, completed. *Baltimore & Ohio—Metropolitan Branch*, extended from Rockville northwest, 9 miles, and from Point of Rocks southwest 7 miles. *Chicago & Northwestern—Menomonee Extension*, extended from Menomonee northward 5 miles. *American Fork* (narrow-gauge), 8 miles of track has been laid on this road from its junction with the Utah Southern. This is a total of 134 miles.

This number of the GAZETTE records the laying of track as follows :

Chicago, Clinton & Dubuque, extended from Bellevue, Iowa, down the Mississippi to a point within 12 miles of Clinton, 26 miles. *Dunkirk, Warren & Pittsburgh*, extended from its late southern terminus at Warren, Pa., west 6 miles to Irvineton. *Poughkeepsie & Eastern*, completed by the extension of the track from Stissing, N. Y., northeastward to the junction with the Connecticut Western at State Line, 25 miles. *St. Paul & Pacific—St. Vincent Extension*, track laid from the junction with the Northern Pacific at Glyndon, Minn., north 64 miles to Red Lake River. *Milwaukee & Northern*, extended from Plymouth northward to New Holstein, Wis., 17 miles. *Walkill Valley*, extended from Rosendale northeast 6 miles to Kingston, N. Y. *Flint River Railroad* (a branch of the Flint & Pere Marquette), completed from its junction with the Flint & Pere Marquette, four miles north of Flint, northeastward up Flint River to Otter Lake, in the northeast corner of Genessee County, Mich. *Central Pacific—Oregon Division*, extended from Red Bluffs north 40 miles to Redding, Cal. *South & North Alabama*, track completed from the northern terminus at Decatur, Ala., southward to Blount's Springs, 53 miles. *Lake Ontario Shore*, track extended westward five miles to a junction with the Southern Central at Fair Haven, N. Y. *Baltimore & Potomac*, track extended from Marlboro southward 45 miles to Pope's Creek, Md., completing the main line.

This is a total of 302 miles of new road.

The Economical Use of Coal.

The following is a portion of the very excellent address of Mr. F. J. Bramwell, President of the Section of the British Association devoted to Mechanical Science. The address was delivered before the Association at their late meeting at Brighton :

Next let us consider how we are dealing with coal when we use it for obtaining motive power in our steam engines.

Steam engines may be divided into the four great heads of marine, locomotive, portable and fixed. Including within the term steam engine the boiler, as well as the engine, waste may arise in a steam engine in two ways, in either one of them, or in both combined. It may arise from an imperfect utilization of fuel in the production of steam, that is a waste due to the boiler, and to the firing, or it may arise in an improper use by the engine of the steam provided for it by the boiler. There can be no question but that the boiler waste is as a rule very large indeed.

A pound of fair coal is theoretically capable of evaporating from the boiling point 13 lb. of water. I do not believe that I shall overstate the case when I say that on an average not more than from one-third to one-half of this quantity is obtained from the whole of the boilers in use.

This poor result varies from a variety of causes—1st, bad firing, which means bad combustion; 2d, insufficient surface to absorb the heat; 3d, an unclean condition of that surface, either from internal or external deposit, or both; 4th, a faulty proportioning of the parts of the boiler to each other, and to the work to be done, which cause heated water to be carried over with the steam, a cause of deficiency of evaporation which, however, so far from being, as a rule, detected, goes to swell the apparent duty of the boiler.

Bad firing may result in the fire being too thick, or too thin, or irregular. If too thick the carbonic acid that is generated by the combustion of the lower part of the fuel with which the air first comes in contact is changed in its passage through the upper part of the fuel into carbonic oxide by absorbing from the fuel a second equivalent of carbon. If this gas, carbonic oxide, does not meet with free atmospheric air, and meet with it at a suitable temperature in the upper part of the furnace, it must remain unconsumed, and will pass through the flues or tubes of the boiler, and make its escape into the air, carrying with it the valuable unconsumed carbon of the coal in a gaseous form. It is commonly said that smoke is unconsumed fuel. This is true; but it is not commonly recollected that there may be invisible smoke arising (even from a coke fire) which shall contain the highly combustible ingredient carbonic oxide gas. When it is remembered that every pound of coal burnt into carbonic acid is capable of evaporating, as has already been said, about 13 lbs. of water from 212 degrees, while a pound of coal converted only into carbonic oxide is capable of evaporating but 4 lbs., it will be seen how necessary it is that no mismanagement of the fire should cause a portion of the fuel thus to escape unburnt up the chimney.

Another defect in the management of a fire (an opposite defect, as it were), by which coal may be wasted, is the admission of too much air; and this arises when the fire is too thin in relation to the chimney draft, or when, a more common evil, it is thin in places owing to the negligence of the firemen in keeping it properly leveled.

The way in which waste arises from these causes is that unnecessary air is introduced into the fire at a temperature of, say, 60 degrees, and that this air has to be heated, and then, even if the heat be abstracted from it as far as practicable by the boiler, it will escape up the chimney at a temperature of from 200 to 300 degrees in excess of that which it had, and the whole of this excess represents wasted coal. Thus on the one hand it is of importance that there should be a proper amount of air to secure the perfect conversion of the carbon into carbonic acid, and on the other hand it is most desirable that this amount should not be exceeded, involving the necessity of uselessly heating air not wanted for combustion. Such a happily balanced state of things it is almost impossible to secure by hand firing; almost impossible, but not absolutely impossible, though only attained at competitive trials, and when these trials are conducted by highly-skilled men.

In such trials of portable engines before the judges of the Royal Agricultural Society of England, the fireman will put coals upon the fire as frequently as 45 times in an hour, the quantity put on at each time being, as may be supposed, little more than a spoonful.

Writers on the management of the steam engine usually advise that the fire-doors should be opened as little as possible, and that the firing should take place about every quarter of an hour.

Under ordinary circumstances they may be right; but when it is desired, regardless of the amount of manual labor, to obtain every particle of useful effect out of the fuel, it is then found to be remunerative to open the door, not four times an hour, but more than 40 times an hour; taking care, however, that it is only opened for the fraction of a second. It is by this frequent feeding of a small quantity of coal distributed over the fire that the competitors are enabled to insure an uniform condition of that fire to receive the action of the air. They know precisely the amount of draught they have got, and by experience they also know what thickness of fire will exactly balance, as it were, the air that comes through, so that the combustion may be perfect, and yet there may be no free air. But in ordinary hand-firing, done at intervals of a quarter of an hour, it is obvious that the thickness of the fire at the end of such an interval must be very different from that which it was at the beginning of it, and thus if that thickness be right in relation to the draught at one time, it must be wrong at another. At one time immediately after firing there may be a distillation of the coal, producing black smoke and carbonic oxide. This will go on till the fire burns thin, and burns into holes, when there will be a passage of free air. I do not wish it to be understood that I am advocating the attendance of skilled firemen to fire 45 times in an hour. Coal must be far dearer than it now is to make it pay so to occupy a man, or rather watches of men, for no one man could submit to such continuous labor for more than four to five hours. But my observations tend to call your attention to the subject of mechanical firing. I believe that the high evaporative duties that have been obtained by the use of liquid fuel, duties approaching very closely indeed to the theoretical power of that fuel, are largely due to the fact that the air and liquid can be injected in definite and regular proportions, insuring perfect combustion.

Again, in the use of powdered fuel by Mr. Crampton, where the powder is blown into the furnace by the very air which is there to enter into combustion with it, very high evaporative results have been reached, even under the disadvantageous circumstances attendant upon early experiments, and this also I believe to be due to the power of accurately adjusting the quantity of air to the fuel to be burnt.

The same power of adjustment may be obtained in those instances where the fuel is previously converted into gas, as practised by Mr. Siemens, and nearly similar control can be got with ordinary fuel by reverting to some of those systems of mechanical fire feeding which were in use from 25 to 30 years ago, but which have to a great extent been abandoned in consequence of the more general adoption of internal fires and high-pressure boilers. The fires of such boilers are in furnaces of small diameter, which do not admit of the introduction of the apparatus, for which room was readily found below the bottoms of the wagon-shaped boilers formerly used for low-pressure steam. Other modes of fire feeding, however, have been devised, and have come to a certain extent into use. It is not the object of this address to enter into the details of such matters as these. I will, therefore, content myself by saying, I am perfectly certain there is hardly any subject more worthy the attention of the engineer than the replacing the stoker by some mechanical arrangement which shall afford absolute uniformity of firing, and, therefore, absolute uniformity of the conditions of the fire; and this is a subject not only worthy of attention on account of the saving of coal, but also on the ground of putting an end to a most laborious, exhausting, and it is to be feared unhealthy occupation, viz., that of the steamboat fireman, more particularly when he is working in a hot climate. If perfect combustion were obtained in the fire, I do not think there would be much difficulty in properly utilising by the boiler the heat evolved. All that is necessary to attain this end is to give a sufficient amount of surface to absorb the heat and to transmit it to the water, always bearing in mind that, above all, the form of the boiler should be a safe one, that there should be proper water space within it, and an adequate water surface from which the steam could escape, that it might do so with tranquility, and so as not to give rise to the spray technically known as "priming," and that all parts of the boiler should be accessible for cleaning.

I am aware there is a temptation on the score of saving expense and of saving room to make the boiler of small size in relation to the amount of coals burnt under it, and to the quantity of steam required from it, but this is a most extravagant economy; it is a saving in the outset, but it is a perpetual source of loss in the working. Temperatures as high as 800 and even 1,000 degrees of heat have been known to exist among the products of combustion escaping from the boiler. Now when it is recollected that every 100 degrees of heat in the outgoing products of combustion represents 2½ per cent. of the whole heating power of the coal, even if only the minimum amount of air to ensure perfect combustion is admitted, it will be seen how necessary it is that there should be sufficient surface in the boiler to absorb the heat of the gases and to bring them down to a few degrees above the temperature of the water in the boiler itself. I have mentioned the temptation to use boilers of inadequate size on the score of expense and on the score of room. It is this latter reason, no doubt, which induces shipowners to endeavor to diminish the size of their boilers as far as practicable, because they argue that the space occupied by the boilers and machinery is all waste room, as it cannot be filled either with coals or with cargo. With short-voyage steamers, voyages of a few hours only, this argument may be a valid one, but for the long-voyage vessels to India and elsewhere, where fuel has to be carried for from 20 to 30 days' steaming, and where on the homeward voyage the ships have to be supplied with coal that has been brought from England by sailing vessels at a large cost for freight, the true space deducted from the cargo and passenger-carrying power of the steamship is clearly not that occupied by the engines and boilers alone, but that occupied by the engines, the boiler and the coal for those boilers. Even supposing that, after enlarging the boilers to diminish the consumption, the space to be given up to the engine boilers and coal were still the same, in consequence of the increase in the size of the boilers being equivalent to the coal space saved, manifestly it would be to the advantage of the shipowner that that space should be occupied by the boilers rather than by the coals.

The expense of the boilers is a first outlay and has not to be repeated for years, until the boilers wear out; but the expense of coal is an outlay that has to be made at every voyage, and, therefore, it is a short-sighted policy to restrict the amount of absorbing surface in a boiler on the plea that a boiler with full surface takes up a greater space in the ship, if by doing away with such restriction a saving can be effected in the fuel.

The beneficial results which are attained by the greater size of boiler, in relation to the coal burnt and to the horse power required, can be shown not only by calculation but by example. In Her Majesty's ship Briton, fitted with extremely economic compound engines, of Mr. E. A. Cowper's design, close upon 2 lb. per horse power per hour were burnt when the ship was making 13 knots, but on being worked at 10 knots the consumption fell to 1 3-10 lb. of coal for the lesser horse power then used.

I will now say a few words upon the engines.

The locomotive engine has for many years past been doing very fair duty. This has arisen, I believe, first from the fact that since the introduction of coal the furnaces have been to a considerable extent gas furnaces with a free admission of air through open fire-doors to the surface of the fuel.

Second, from the fact that the boilers have large absorbing surfaces. From these causes as much as 9 lb. or 10 lb. of cold water are commonly evaporated per lb. of coal, while the engines working with high steam and considerable expansion, make a good use of that steam.

(2) In marine engineering there has within the last 10 years been an enormous improvement. The old-fashioned engine, working at 20 lb. steam and with injection condensers, is being abandoned for engines generally on the compound cylinder principle, working at 60 lb. and 70 lb. steam highly expansive, and fitted with surface condensers. The result is a reduction of the consumption of fuel in the same vessels, on the same voyages and performed in the same time, of from 40 to 50 per cent. of that which was previously burnt; but I believe that a large field for improvement in marine engines still remains, especially in the firing and in the size of the boilers.

Among the best instances of what can be done in the way of economy may be mentioned the rapidly increasing class of portable agricultural engines.

These engines, like the locomotive, are, from their migratory condition, incapable of being fitted with condensers, and thus must be worked as non-condensing engines, exhausting their waste steam into the air, a most serious disadvantage nevertheless; so great advances have been made by the unremitting attention of the extremely skillful mechanical engineers who construct these engines, that at the late Cardiff meeting of the Royal Agricultural Society of England, one of the engines (the prize engine, that of Messrs. Clayton and Shuttleworth) ran for

5 hours and 1 minute with 14 lb. of coal per horse power, being, therefore, a little under 2 8-10 lb. of coal per horse power per hour, and this horse was the horse power of the dynamometer brake, and not the mere indicated horse power by which marine engines and other engines are ordinarily judged. The indicated horse power is of course in excess of that developed upon the brake, as the indicated power includes all the engine friction and brake friction, and if this latter horse power be taken as a standard, the best of the engines tried by the Royal Agricultural Society this year at Cardiff will offer favorable comparison with even very good condensing engines, and will be found to give a duty far beyond that which ten years ago would have been thought obtainable in any but the very best.

It may be mentioned that the Cornish pumping engines, which used to be looked upon as the most economic of all engines, are, according to the June monthly report, doing only an average duty of 53 3-10 millions of lb. lifted 1 ft. high for 1 cwt. of coals, and that the very best of them is doing only 71 7-10 millions of lb., while the brake horse power developed by Messrs. Clayton and Shuttleworth's engine at Cardiff gave a duty of 79 2-10 millions of lb.

This large duty was due to the great ability in the management of the fire (as has already been hinted at), and to the proper proportion of the boiler in obtaining the steam, and to its thorough cleaning in preserving it in the first instance, and then to the efficient utilization of that steam by high expansion in a cylinder, steam-jacketed around its circumference and at the ends. But at the very same show there competed for the prize an engine which, to the eye of the uninstructed (the ordinary purchaser for example), was as likely an engine as the prize engine, and yet this engine burnt 10 lb. of coal per horse per hour, or nearly four times that which was burnt by the prize engine; and, moreover, it must be remembered that this wasteful engine was one which the maker thought worthy to be sent to trial. How many are there, therefore, among those which makers do not think worthy to be sent to trial which must deal as wastefully or more wastefully with coal, and are, for the sake of a few pounds in the first cost, bought by ignorant purchasers, who go on committing the sin of wasting coals with such engines until they are worn out, the loss becoming greater with the age of the engine.

It may be said that hitherto my observations upon consumption in steam engines have contained quite as much of praise as of blame, and I am glad to say that it has been so; but it will be found that these praises have referred to the engines of railways, which are under the special charge of educated mechanical engineers, who carefully watch and tabulate all their results, and who have funds at their disposal for the purchase and maintenance of good engines; that they refer ed to the recent improvement in marine engines, which engines being, as a whole, in the hands either of powerful companies or of large capitalists, enjoy the advantages of due outlay and of proper superintendence; and that they referred to the prize engines and to the better competitive engines of the portable class, while admitting the existence of a large number of such engines which were most destructive of fuel. But there remains the great class of fixed engines, used for driving manufactories, which engines are, as a rule, of the most disgraceful and scandalous character. In the first place, enormous numbers of them are non-condensing engines; as an excuse for this it is in many instances alleged that water is scarce, and that there is not, therefore, the means of providing condensation. To meet such excuses, it should be remembered there are appliances well known to scientific engineers, at all events, that have been in use for many years, by which condensation can be effected with no more water than is required for the feed of a high-pressure engine; I allude to the ordinary cooling ponds for irrigation water, and to the surface evaporative condenser. In every instance these may be employed, and thus, in lieu of sending steam into the atmosphere at a pound or two above atmospheric pressure, that steam might be condensed, and a pressure of 12 or 13 lb. additional throughout the whole stroke of the piston might be obtained; moreover, the interior of the boiler would be kept clean, and thus its surface would be in the best state for transmitting heat.

But passing by this question of the repugnance to the use of condensing engines, and admitting for the sake of argument that non-condensing engines may be allowed, what does one ordinarily find as a type of the non-condensing engine. One finds the cylinder with a cubic capacity far too great for the work required, where steam is used throughout the stroke; one finds that this capacity is not utilised as it might be by the employment of high-pressure steam and considerable expansion, and that while the steam even in the boiler is probably at only 40 lb. above atmosphere, the governor is flying out nearly to the full width, the throttle valve is all but closed, and there is a continuous wire-drawing of the steam, so that its average pressure throughout the stroke of the cylinder is only some 15 or 20 lb. above atmosphere. Now when one recollects that it requires one portion of coal to get steam up to atmospheric pressure, and that this portion may be looked upon as practically constant, whatever pressure of steam above atmosphere may after be attained, and that if therefore steam at 15 lb. above atmosphere be used, half of all the fuel is lost, while if at 30 lb. above atmosphere, one-third only is lost, and if at 120 lb. above atmosphere, one-ninth only will be lost in getting up steam to atmospheric pressure, one can understand how essential it is that in non-condensing engines the steam should be used at a really high pressure, and yet, as I have said, I believe that if the large number of 10 or 20-horse horizontal non-condensing engines employed by manufacturers throughout the kingdom were examined, and indicator diagrams were taken, it would be found that their pressure upon the pis ons did not average much more than 20 lb. above atmosphere; and it is a lamentable fact that many makers of steam engines, men who cannot properly be called engineers, men who are mere manufacturers, not knowing the principles of the art they follow, will boast that their engine is doing very well, it drives the whole of Mr. So-and-So's work, and does not require more than 30 lb. of steam in the boiler, not understanding that if they would raise that steam to 120 lb., and then work it non-expansively in a small cylinder, they would thereby be obtaining a great economy, and if they would work it expansively in a large cylinder, that cylinder being properly steam-jacketed, they would obtain a still greater economy.

I have now laid before you some of the points in which the boilers and engines of the present day are below the standard to which engineering science has already reached, and in which, therefore, there is known opportunity for immediate improvement.

I think there is so little relisble information as to the total horse power at work in the United Kingdom, as is evidenced by the fact that very recently the number of boilers has been estimated before a Parliamentary committee as low as 50,000, and as high as double, and even close upon quadruple that number, that I feel it would be an unwarrantable waste of the time of the section if I were to invite them to follow me into calculations, or rather speculations, as to the exact saving that would be made in the consumption of coal consequent upon improving the whole of our steam engines up to the present highest standard. It will, however, be quite sufficient to show the importance of the question for me to say, and I am sure I should be perfectly safe in saying that such saving would have to be estimated by millions of tons.

A saving, as I have said, is one that might be made with our present knowledge; but when we recollect that an engine burning even as low as 2 lb. of coal per indicated horse power per hour is still developing only one-tenth of all the power which, according to calculation, resides in that coal, there is manifestly a vast scope for our mechanical engineers in the exercise of their talents for further economy.

But let not consumers of coal remain indifferent to savings on their present consumption until those improvements are discovered by scientific men; on the contrary, let them forthwith do everything in their power to reduce the consumption to the extent to which present science, and in some instances present practice, show the consumption can be reduced. One is apt, at first sight, to marvel that users of steam engines should be so blind to their own interest, and should permit waste to go on day after day and year after year, a waste not only prejudicial to the community at large and to succeeding generations, but a waste causing constant expense to those who commit it, and a waste, therefore, that one would think such persons would only be too ready to stop, but the fact is there are several reasons why manufacturers and others permit the waste to go on.

In prosperous times those engaged in manufactures are too busy earning and saving money to attend to a reorganization of their plant; in bad times they are too dispirited and too little inclined to spend the money that in better times they have saved in replacing old and wasteful appliances by new and economical ones, and one feels that there is a very considerable amount of seeming justification for their conduct in both instances, and that it requires a really comprehensive and large intelligence, and a belief in the future, possessed by only a few out of the bulk of mankind, to cause the manufacturer to pursue that which would be the true policy, as well for his own interest as for those of the community. But there is a further and a perpetual bugbear in the way of such improvements, and that bugbear is the so-called "practical man," and he was in my mind when, in previous parts of this address, I have hinted at the existence of an obstacle to the adoption of improvement.

I do not wish the Section for one moment to suppose that I, brought up as an apprentice in a workshop, and who all my life have practiced my profession, intend to say one word against the truly practical man. On the contrary, he is the man of all others that I admire, and by whom I would wish persons to be guided, because the truly practical man is one who knows the reason of that which he practices, who can give an account of the faith that is in him, and who, while he possesses the readiness of mind and the dexterity which arise from the long-continued and daily intercourse with the subject of his profession, possesses also that necessary amount of theoretical and scientific knowledge which justify him in pursuing any process he adopts, which in many cases enable him to devise new processes, or which, at all events, if he be not of an inventive quality of mind, will enable him to appreciate and value the new processes devised by others. This is the truly practical man, about whom I have nothing to say, except that which is most laudatory; but the practical man, as commonly understood, means a man who knows the practice of his trade and knows nothing else concerning it; the man whose wisdom consists in standing by, seeing, but not investigating, the new discoveries which are taking place around him, in decrying those discoveries, in applying to those who invent improvements, even the very greatest, the epithet of "schemers," and then when he finds that, beyond all dispute, some new matter is good, and has come into general practice, taking to it grumblingly, but still taking to it, because if he did not he could not compete with his co-manufacturers; the aim and object of such a man being to insure that he should never make a mistake by embarking his capital or his time in that which has not been proved by men of large hearts and large intelligence.

It is such a practical man as this who delays all improvement. For years he delayed the development in England of the utilization of the waste gases of blast furnaces, and he has done it so successfully that, as I have already had occasion to remark, this utilization is by no means universal in this kingdom. It was such men as these who kept back surface condensation for 20 years.

It is such a man as this who, when semaphores were invented, would have said, "Don't suggest such a mode to me of transmitting messages; I am a practical man, sir, and I believe that the way to transmit a message is to write it on paper, deliver it to a messenger, and put him on horseback."

In the next generation his successor would be a believer in semaphores, and when the electric telegraphist came to him and said, "Do you know that I can transmit movement by invisible electrical power through a wire, however long, and it seems to me that if one were to make a code out of this movement, I could speak to you at Portsmouth at one end of the wire while I was in London at the other," what would have been the answer of the practical man? "Sir, I don't believe in transmitting messages by an invisible agency, I am the practical man, and I believe in semaphores which I can see working."

In like manner, when the Siemens regenerative gas furnace was introduced, what said the practical man? "Turn your coals into gas and burn the gas, and then talk of regeneration. I don't know what you mean by regeneration, except in a spiritual sense; I am a practical man, and if I want heat out of coals I put coals on to a fire and burn them;" and for 15 years the practical man has been a bar to this most enormous improvement in metallurgical operations.

The practical man is beginning slowly to yield with respect to these furnaces, because he finds, as I have already said, that men of greater intelligence have now, in sufficiently large numbers, adopted the invention to make a formidable competition with the persons who stolidly refuse to be improved.

The same practical man for years stood in the way of the development of Bessemer steel. Now he has been compelled to become a convert.

I will not weary you by citing more instances, but one knows, and one's experience teaches one that this is the conduct of the so-called practical man, and his conduct arises not only from the cause which I have given (his ignorance of the principles of his profession), but from another one which I have had occasion to allude to when speaking upon a different subject, and that is you offend his pride when you come to him and say, "Adopt such a plan; it is an improvement on the process you carry on." His instinct revolts at the notion that you, a stranger, very likely his junior, and very probably, if the improvement be an original and radical one, a person not even connected with the trade to which that improvement relates, should dare to assert that you can inform him of something connected with his business that he did not know.

It may be said that employers and the heads of manufactories are as a rule in these days educated gentlemen, and that, therefore, it is wrong to impute to them the narrow-mindedness of the practical man. I agree that in numerous instances this would be wrong, but the fact is that in many cases, I think I may say in most cases, the head of the establishment, the moneyed man, the man by his commercial ability (that most necessary element in all establishments), keeps the concern going by finding lucrative orders, is not intimately acquainted with the practice of the business carried on by his firm; he relies upon some manager or foreman, who too commonly is not the real, but the so-called, practical man; it is such men as those, who simply practice that which they have seen, without knowing why they practice it; to them the title of practical man has most improperly been attributed, and it is on the advice of such men that the true heads of the firm too commonly regulate their conduct as to the management of their business, and as to the necessary changes to be made in the way of improvement.

As I have said, the practical man derides those who bring forward new inventions, and calls them schemers. No doubt whatever they do scheme—and well it is for the country that there are men who do so—it also may be true that the majority of schemes prove abortive, but it must be recollected that the whole progress of art and manufacture has depended, and will depend, upon successful discoveries which in their inception were and will be schemes, just as much as were those discoveries that have been and will be unfruitful; but the successful discoveries, because they are successful, are taken out of the category of schemes, when years of untiring application on the part of the inventors have, so to speak, thrust them down the throat of the unwilling practical man. Take the instance of Mr. Bessemer, who was beset for years by difficulties of detail in his great scheme of improvement in the manufacture of steel. As long as he was so beset the practical men chorused, "He is a schemer: he is one of the schemers; it is a scheme."

Supposing that these practical difficulties had beaten Mr. Bessemer, and that they had not been overcome to this day, the practical man would have derided him still as a schemer, although the theory and groundwork of his invention would have been as true under these circumstances as it now is. Fortunately for the world, and happily for him, he was able to overcome these most vexatious hindrances, and make his invention that which it is. No one now dare to apply the term "schemer" to Mr. Bessemer, or "scheme" to his invention; but it is as true now that he is a schemer and his invention a scheme as it would have been had he failed up to the present to conquer the minor difficulties. It is a species of profanation to suggest, but I must suggest it, for it is true that Watt, Stephenson, Faraday and almost every other name among the honored dead, to whose inventive genius we owe the development that has taken place within the last century in all the luxuries, the comforts, and even the bare necessities of our daily existence, would in their day, and while struggling for success, have been spoken of as schemers, even in respect of those very inventions of which we are now enjoying the fruits. But I feel I need not labor this point further at a meeting of the Mechanical Section of the British Association—an association established for the advancement of science.

I know I shall be accused of decrying the practical man and of upholding the schemers. I say most emphatically that I do not decry the practical man, I plead guilty to the charge of decrying the miscalled practical man; and I glory in my guilt, while I readily accept that which I consider the praise of upholding "schemers," and I do so for this simple reason, that if there were no schemers there would be no improvement.

I think it becomes a scientific body like the British Association to laud the generous effort of the unsuccessful inventor rather than to encourage the cold selfishness of the man who stands by and sees others endeavor to raise the structure of improvement without lending a hand to help, and even sneers at the builders; but when the structure is fully raised and solidly established, claims to come in and to inhabit, and probably essays, cuckoo-like, to oust the builders and to take possession for his own benefit.

General Railroad News.

PERSONAL.

—A correspondent of the Cleveland *Herald*, writing under date of August 20, gives the following sketch of the railroad service of the late Thomas Denmead:

"Thomas Denmead died at his home in Dennison, on Wednesday morning, aged 64 years. His illness was short, terminating with congestive chills. Mr. Denmead was born in Baltimore, Md. He has been actively engaged in railroad interest for many years, being foreman of the Baltimore & Ohio Railroad Company for ten years, afterward resuming for a time the superintendency of the machine shops of the same company at Martinsburg, Va. He also occupied a prominent position in the locomotive works at Alexandria, Va., and in 1856 became Master Mechanic of the Baltimore & Ohio Railroad, at Wheeling, Va. In the same year the Steubenville & Indiana Railroad Company tendered him a similar position on their lines, which he accepted and retained until February, 1872. He maintained a personal oversight of the Dennison machine shops at Dennison, and had resided there since 1869."

ELECTIONS AND APPOINTMENTS.

—At a meeting of the stockholders of the Harrisburg & Lancaster Railroad Company in Philadelphia, recently, the following board of directors was elected: J. Edgar Thomson, Josiah Bacon, Wistar Morris, Samuel T. Bodine, Joseph B. Myers, Edward C. Knight, Washington Butcher, John M. Kennedy, James Magee, James Young (of Middletown) and Lewis Elkin. These directors are all re-elected. The road is leased by the Pennsylvania Railroad Company.

—The Allegheny Valley Railroad Company having taken possession of the Oil Creek & Allegheny River Railroad, September 2, under a lease, Mr. William Phillips, the President, announced the following appointments, taking effect that day: J. J. Lawrence, Pittsburgh, General Superintendent; Charles J. Hepburn, Oil City, Assistant Superintendent; F. A. Phillips, Corry, Auditor, Secretary and Treasurer. Mr. Lawrence is the General Superintendent of the Allegheny road; Mr. Hepburn was Superintendent of the Oil Creek & Allegheny River road under the old management, and Mr. F. A. Phillips has been the Secretary and Treasurer of that road.

—At the annual meeting of the Nashville & Chattanooga Railroad Company in Nashville August 14, the directors were all re-elected; they are: E. W. Cole, John M. Bass, G. M. Fogg, John Frizzell, E. L. Jordan, John N. Childress, Thomas Lipscomb, Thomas C. Whitesides, V. K. Stevenson, John F. Anderson, John B. Hawkins, A. E. Patton, Jackson Pryor, W. S. Huggins, Ben May. The officers chosen are E. W. Cole, President; J. W. Thomas, General Superintendent; W. A. Gleaves, Treasurer; R. C. Morris, Resident Engineer; A. L. Landis, General Agent; all of Nashville.

—Mr. Francis M. Johnson has been appointed to fill a vacancy in the Massachusetts Board of Railroad Commissioners. Mr. Johnson is a resident of Newton, Mass. The Springfield *Republican* says he is "a man little known to the general public, but believed to possess most admirable qualities for the position. He is the head of a large hide and leather house in Boston, and has been very successful in the business, the details of which he now leaves to his younger associates. He brings to the duties of his new position long and intimate experience in transportation matters, a thorough business education, the highest personal integrity, intelligence in public affairs and great firmness of character—all needed qualifications in a railroad supervisor, and sure to make him a valuable addition to this most important commission."

—At a meeting of the stockholders of the Painesville, Warren & Pittsburgh Railroad Company, at Painesville, Ohio, September 3, the following board of directors was elected: Robert McCormick, H. H. Hins, G. E. Paine, S. H. Kimball, Samuel Moody, H. R. Dickinson and H. P. Sanford. The following officers were subsequently chosen: President, George E. Paine; Vice-President, H. R. Dickinson; Secretary and Treasurer, Robert McCormick.

—At the annual meeting of the stockholders of the Helena & Iron Mountain Railroad Company, held at Forest City, Ark., September 2, Mr. Joseph J. Horner, of Helena, was elected President; W. H. Cate, of Craighead County, Vice-President, and E. M. Moore, of Helena, Secretary. Mr. Horner takes the

place of Col. D. C. Cross, and Mr. Moore that of J. C. McCabe. Colonel Cross still remains in the board of directors.

—The Allegheny Valley Railroad Company having purchased the Oil Creek & Allegheny River Railroad, Mr. J. J. Lawrence, General Superintendent of the Allegheny Valley road, takes charge of the whole road, and Mr. Charles J. Hepburn, heretofore Superintendent of the Oil Creek & Allegheny River road, retains his position, with the title of Assistant Superintendent. Mr. Edward F. Gay, President, and Mr. John Pitcairn, Jr., General Manager, of the Oil Creek road, have resigned their positions. Mr. Gay is succeeded as President by Mr. William Phillips. Assistant Superintendent Hepburn's office will be in Oil City, instead of Corry, as heretofore.

—At the annual meeting of the Monticello & Port Jervis Railroad Company, at Port Jervis, N. Y., September 5, the following board of directors was chosen: S. O. Dimmick, Geo. Malvin, Frank Marvin, F. R. Brodhead, A. B. Goodale, O. F. Sherman, Frank Perkins, W. H. Cady, C. V. R. Ludington, E. W. Fairchild, Stephen W. Royce, T. A. Niven, Ed. Hartwell, W. W. Gillman, O. J. Brown. The directors subsequently elected the following officers: S. O. Dimmick, President; T. A. Niven, Vice-President; Francis Marvin, Secretary; George Malvin, Treasurer; C. V. R. Ludington, Attorney.

—At a meeting of the stockholders of the Baltimore & Potomac Railroad Company, at Baltimore, September 4, George B. Roberts, of Philadelphia; J. N. DuBarry, of Harrisburg, Pa.; Wm. D. Bowie and Wm. T. Walters, of Baltimore; Samuel Cox, of Port Tobacco, Md.; Dr. Eli J. Henkle, of Brooklyn, Md.; and James C. Clarke, of Hagerstown, Md., were elected directors. At a subsequent meeting of the board, Hon. Oden Bowie was elected President; J. N. DuBarry, Vice-President and General Manager; S. Little, Secretary and Auditor; and J. S. Leib, Treasurer. The above are all re-elected.

—At a meeting of the directors of the Missouri Pacific Railroad Company, held August 27, Gen. Clinton B. Fisk was elected a director, in place of Joseph Seligman, of New York, who has lately resigned. Mr. John L. Dearborn was appointed Treasurer in place of John C. Porter, who has resigned the position of Treasurer, but still holds that of Secretary. Mr. Dearborn is now Cashier of the Atlantic & Pacific Company.

—The present officers of the North Pacific Coast Railroad Company are: A. D. Moore, President; H. B. Platt, Vice-President; William H. Tillinghast, Treasurer; George G. W. Morgan, Secretary; James T. Boyd, Attorney. Directors—James McM. Shafter, H. B. Platt, Tyler Curtis, W. H. Ladd, Lewis Gerstle, Chas. Webb Howard, J. P. Moore, W. F. Russell, A. D. Moore, W. H. Tillinghast, W. Dutton, James T. Boyd, S. P. Taylor.

—At a meeting of the stockholders of the Lamoille Valley Railroad Company at Hyde Park, Vt., August 13, the following board of directors was chosen: James D. Bell, Adolphus Holton, Olif Abel, George W. Hendee, Waldo Brigham, Orange Buck, R. S. Read, D. D. Weed, O. S. Rixford and A. B. Jewett. The only change in the board is in the election of Mr. Holton, who takes the place of Franklin Fairbanks. At a subsequent meeting of the directors the following officers were chosen: President, Waldo Brigham; Vice-President, Franklin Fairbanks; Clerk, J. H. George; Treasurer, D. D. Weed.

—At the annual meeting of the Ware River Railroad Company the following directors were chosen: Charles A. Stevens, of Ware, Mass.; William W. Whitney, of Winchendon, Mass.; Charles A. Perley, of Templeton, Mass.; William Mixter, of Hardwick, Mass.; F. B. Fiske, P. W. Holmes, Thomas H. Hubbard, Chauncey Vibbard and Alex. P. Fiske, of New York. The board of directors subseqnently organized by choosing Charles A. Stevens, of Ware, President, and Otis Lowe, of Ware, Secretary and Treasurer.

—At a meeting of the Cincinnati, Rockport & Southwestern Railroad Company at Rockport, Ind., August 26, the following directors were chosen for the ensuing year: A. S. Goshorn, James M. Glann, S. S. L'Hommedieu, Garard Joseph Kinsey, Henry Lewis, E. H. Gabins, L. J. Debruler, John Mollen, Jacob Seasongood, J. Welborn, John A. Mann.

—The officers of the St. Louis & Florissant Railroad Company are: President, Erastus Wells; Vice-President, E. G. Obear; Secretary, H. L. Conn; Treasurer, Logan D. Dameron. Directors—Erastus Wells, E. G. Obear, Dr. J. C. Page, D. W. Bell, R. J. Watson, Wm. T. Gay, L. D. Cabanne, Michael Powers, Joseph Lindenschmit, C. D. Blossom, Logan D. Dameron, George H. Rea and W. J. Lewis.

—Mr. John Gregory Smith has resigned the presidency of the Northern Pacific Railroad Company, assigning as the reason therefor the condition of his health and the demands upon his energies made by the great and growing Vermont Central Company, of which he is President. Mr. George W. Cass, President of the Pittsburgh, Fort Wayne & Chicago Company, the Continental Improvement Company, and the Southern Railway Security Company, a very able and successful railroad officer, has been chosen by the directors to succeed Mr. Smith. Mr. Cass, it is said, will hereafter reside permanently in New York, and give his chief attention to the affairs of the Northern Pacific.

—Mr. John Colgate is appointed Auditor of the Eastern Railroad Company, not of the Boston & Maine, as this and other newspapers have announced. By the way, some newspapers have spoken of Mr. Charles F. Hatch, late of the Lake Shore & Michigan Southern, as General Manager of the Boston & Maine, instead of the Eastern.

—Mr. John B. Dutton has been appointed General Agent of the Central Branch Union Pacific Railroad, with headquarters at the general offices in Atchison.

—The following are the officers of the New York, Housatonic & Northern Railroad Company since its consolidation with the Southern Westchester: L. D. Rucker (late General Superintendent of the Erie Railway), President; David S. Duncomb, Vice-President; Thomas Clark, Jr., Financial Director; Sewell Sergeant, Secretary and Treasurer.

—The Secretary informs us that at the annual election of the Massawippi Valley Railway Company, held in Stanstead, Quebec, September 4, the old board was re-elected, as follows: Sir A. T. Galt, President, Montreal; Colonel B. B. Pomroy, Compton, Province of Quebec; B. P. Cheney, Boston, Mass.; C. Brooks, Lennoxville, Quebec; C. C. Colby, Stanstead, Quebec; E. Raymond, Thomas Upham, Cambridge, Mass.; Albert Knight, Stanstead, Quebec; E. Cleveland, Coventry, Vt. A. P. Ball, of Stanstead, was re-elected Secretary, and S. Foster, of Stanstead, Treasurer. The Connecticut & Passumpsic Rivers Company leases and works the road.

—It is reported that Mr. James H. Hoyt has offered his resignation as Superintendent of the New York & New Haven Railroad, to take effect October 1.

TRAFFIC AND EARNINGS.

—The earnings of the Chicago & Alton Railroad for the month of August were: 1872, $572,331; 1871, $534,162; increase, $38,169, or 7¼ per cent.

—The earnings of the Cleveland, Columbus, Cincinnati & Indianapolis Railroad for the month of August were: 1872, $404,286; 1871, $366,227; increase, $38,059, or 10¼ per cent.

—The earnings of the Lake Shore & Michigan Southern Railway for the month of August were: 1872, $1,440,873; 1871, $1,295,369; increase, $145,504, or 11¼ per cent.

—The earnings of the St. Louis, Alton & Terre Haute Railroad for the month of August were: 1872, $171,537; 1871, $175,106; decrease, $3,569, or 2 per cent.

—The earnings of the Toledo, Peoria & Warsaw Railroad for the month of August were: 1872, $127,851; 1871, $94,637; increase, $33,214, or 35¼ per cent.

—The earnings of the Erie Railway for the month of August were: 1872, $1,525,243; 1871, $1,764,556; decrease, $239,315, or 13½ per cent.

—The earnings of the Illinois Central Railroad for the month of August were: 1872, $763,256; 1871, $836,040; decrease, $72,784, or 8¾ per cent.

—The earnings of the Milwaukee & St. Paul Railway for the month of August were: 1872, $565,728; 1871, $506,557; increase, $59,171, or 11¾ per cent.

—The following is a statement of the earnings and expenses of the Union Pacific Railroad Company for the month of July, and the first seven months of the current year:

	July, 1872.	July, 1871.
Earnings	$743,382 53	$673,693 13
Expenses	847,840.17	318,302 33
Net earnings	$385,542.36	$355,390.79
	Jan. 1 to July 31, 1872.	Jan. 1 to July 31, 1871.
Earnings	$4 584,999.24	$4,083,977.70
Expenses	2,744,983.58	3,005,189.66
Net earnings	$1,840,015.66	$2,078,788.04

Gross earnings 1872, compared with 1871, show: For July, increase, $69,689.41; for six months previous, increase, $431,332.13; and for seven months, increase, $501,021.54.

Net earnings 1872, compared with 1871, show: For July, increase, $30,151.57; for six months previous, decrease, $268,923.95; and for seven months, decrease, $238,772.38.

—The earnings of the Milwaukee & St. Paul Railway for the month of August were as follows:

	1871.	1872.
Freight	$389,132 06	$333,587 22
Passenger	166,523 56	176 990 09
Mails, express, etc	50,901 39	55,151 41
Total	$606,557 01	$565,728 72
Increase		59,171 71

or 11¾ per cent.

—The approximate earnings of the Marietta & Cincinnati Railroad for the month of August were: 1872, $162,521; 1871, $137,341; increase, $25,180, or 18¼ per cent.

—The earnings of the Kansas Pacific Railway for the month of August were: 1872, $349,381.80; 1871, $332,554.97; increase, $16,826.83, or 5 per cent.

—The earnings of the Rome, Watertown & Ogdensburg Railroad for the month of August were: 1872, $127,120; 1871, $123,564; increase, $3,556, or 2¾ per cent.

—The earnings of the Central Pacific Railroad for the month of August were: 1872, $1,288,297; 1871, $1,006,373; 1870, $807,815; increase this year over 1871, $281,924, or 28 per cent.; this year over 1870, $480,482, or 59½ per cent. For the first eight months of the year the earnings were: 1872, $7,972,208; 1871, $5,920,552; 1870, $5,018,280; increase this year over 1871, $2,051,656, or 35¾ per cent.; increase this year over 1870, $2,953,928, or 58⅞ per cent.

—The earnings of the Toledo, Wabash & Western Railway for the month of August were: 1872, $614,175; 1871, $552,079; increase, $62,096, or 10⅛ per cent.

—The earnings of the St. Louis & Iron Mountain Railroad for the month of August were: 1872, $195,050; 1871, $131,490; increase, $62,560, or 47½ per cent. For the first eight months of the year the earnings were: 1872, $1,431,523; 1871, $1,004,776; increase, $429,747, or 42¾ per cent.

—The earnings of the St. Louis, Kansas City & Northern Railway for the first week in September were: 1872, $70,471; 1871, $69,706; increase, $765, or 1⅛ per cent.

CHICAGO RAILROAD NEWS.

Chicago & Alton.

This road is now steadily increasing its earnings over its last year's rate. For the month of August, 1872, they were $572,331.82, while for the same month last year, they were $534,162.66, an increase for the present year of $38,169.16.

Pittsburgh, Fort Wayne & Chicago.

This company has decided to issue commutation tickets to the Soldiers' and Sailors' Convention, which is to be held in Pittsburgh on the 17th inst. The fare for the round trip from Chicago to Pittsburgh and return will be $18.75. The tickets will be good from the 14th to the 21st. The first train leaves Chicago at 5:15 p. m., on Sunday.

Milwaukee & Chicago.

This company has its track laid nearly to Racine, but some delay in the progress of the work has occurred from the fact that the iron has not been received as promptly as it was expected. The track will not be completed to Chicago, as a consequence, quite so soon as it has been expected.

Chicago & Northwestern.

This company is making arrangements to build a direct line of road from Milwaukee to Fond du Lac, thus shortening the distance between this and the latter city.

The Chicago *Tribune* publishes an account of an attempt made on Sunday, September 8, by the Chicago, Danville & Vincennes Company, to lay a switch from their track to connect with the Chicago & Northwestern road, near the North Chicago Rolling Mills. The project was frustrated, the paper says, by a large force of police, acting in concert with men sent on the ground by the Northwestern Company.

THE SCRAP HEAP.

An Engineman's Report of Repairs Wanted.

A correspondent of the *Locomotive Engineers' Journal* gives the following as an accurate copy of a report made by a capable engineman to his master mechanic. He seems to have been able to detect as many defects in his engine as anyone could with his composition and spelling, and as the knowledge of the engine was the essential thing with him, we can hardly say that the report is a discreditable one, though we do laugh at it:

"ERIE RAILWAY SHOP, Orgust 3, 1876.

"Engine —— staitment of Wat she wants doin to Her—new Packen in sillynders ande valvee Ceats fase. new bushins in steeme Cheasts ande stemes trude upe Pistens too, all so sillynders too—gides on Cros Heds line upe. Bushin in pumps too wants New ones and valves over Hall—lost motion. Rocker Box tock upe and exenTricks strapes too, new Brassess in front ende of both maine Roddes i think. Parell Roddes wants new Brassess too Back Driver Wheails i think Pines is lose—Boxes wants examende, ande tires turnd of ingector put down betune Driver Wheails. Fet Cok on top of ire ChamBer Put down on side of air ChamBer new oile Cupes put on front ende of maine Roddes tale Peace lose on back end fraime—Blo of Cok wants grind in or a new cok Engine down behind wants gack upe an more sett in Springs. Petticote burnted out wants new one hier upe lost moshin tock upe all Rounde and valves set squarer.

"Tender trucks overHall i wood like to have Peeces of iron put inside of Tender to hold a Bunker borde to Ceape cole from Roiling out—top Gage Cok wants a new one examen truck Boxes thar seams to be good Eal of side play to Boxes—the Wheails want one Pare of new Wheails front ones springs wants more set into them—Back ones tender Behind lekes bad Wants Patch on it Engin wants Gen. OverHall ande be pante an varnish all over too. GIM BASSWOOD Eug,r.

"p. M.—Ash Pan Back Side has got a hoal in to it. and Biler wants korkin on top whare it lekes and pop valves skrewin down sum and a hoal in the knittin work wants fixin too—"

What the Springfield Depot is Like.

The Springfield, (Mass.) *Republican* says:

"As one of the evening trains was coming into the depot the other night, a little girl, who saw the flaring lights and general diabolical appearance of the place, nestled up to her mother's side, and inquired in an awe-struck whisper, 'Mamma, is this hell?' Was that one of the babes to whom wisdom is given?"

Heavy Forgings.

Among the heaviest articles ever sent by railroad are two large paddle shafts lately sent from Bridgewater, Mass., to the Pacific Mail Steamship Company at San Francisco. They were nearly 40 feet long, 26 inches in diameter, and weighed together over 71 tons.

OLD AND NEW ROADS.

Atchison & Nebraska.

Time table No. 1, which took effect September 1, gives trains through between Atchison and Lincoln. The mail and express leaves Atchison at 12:25 p. m. and reaches Lincoln, 146½ miles, at 8:20 p. m. Returning, it leaves Lincoln at 6:00 a. m. and reaches Atchison at 1:50 p. m. There is also a through freight train (making the distance in about 10½ hours), and an accommodation between Atchison and Falls City, 55 miles.

Ceredo Mineral and Railway Company.

This West Virginia company is building a narrow-gauge coal road from Ceredo, on the Ohio River, to the coal deposits on Twelve Pole River and its branches. It has let the contract to build thirty miles of the road, by which they will penetrate several miles into the coal field, and intend to extend their road further as fast as the mining and other interests demand it. A force of men is at work grading on the Ceredo end of the line.

Atlanta & Richmond Air Line.

A correspondent at Greenville, S. C., writes, August 30: "It will not be long before tracklaying commences on the Atlanta & Richmond Air Line Railroad at this point. The company is building a transfer railroad between the Greenville & Columbia and the Air Line, which will be completed in about six weeks. A good deal of the iron is on the ground now."

Great Western of Canada.

We have the following authoritative information of the Great Western Air Line to Buffalo, extending east from Glencoe, a point 80 miles east of Detroit:

"It is all graded and the bridges finished ready for track laying from Glencoe to the junction with the Grand Trunk Railway at Canfield, a distance of 103 miles and about 42 miles miles from Buffalo. The laying of the track was begun in July and is being rapidly pushed forward. The extension from Canfield Junction to the International Bridge, now in course of construction across the Niagara River from Fort Erie to Buffalo, is now being rapidly graded and will be ready for the track before the 1st of November next.

"The whole 145 miles are nearly straight; the excess in length over an air line being only four miles. There are few curves on the line and none sharper than two degrees. The banks are all graded to 16 feet wide, and the cuttings are 22 feet in width at the bottom. The grades on the road are extremely favorable, upward of one-half of the line being either level or less than five feet per mile above or below the level. There are a few grades of short lengths of from 30 to 35 feet per mile, but nothing steeper.

"The bridges are either of first-class masonry or of the best quality of pine timber truss and trestle work.

"Special attention has been paid to drainage to secure the best possible foundation for the steel track. The track is to be laid entirely of the best quality of Bessemer steel, weighing 66 lbs. to the yard. The joints of the rails to be fished with four bolts and nuts, with a wrought-iron chair in addition, to increase the bearing on each joint tie. The ties are 8 inches wide on the face, 9 feet long, and laid 2 feet apart from center to center. The ballast throughout will be 12 inches in depth under the ties. The steel track of this road will certainly be superior to any yet laid on this continent.

"With respect to the main line track, we have now 125 miles of steel rails laid, and before the 1st of December will have 160 miles out of the 229. The water tanks will be of Burnham's most approved patent frost-proof, each tank having a capacity of 30,000 gallons.

"Fifty-seven locomotives are under contract, 36 at the Locomotive Works, Providence, Rhode Island; 10 at Baldwin's Works, Philadelphia; and 11 at the Canadian Engine and Machinery Company's Works, at Kingston, Ontario. Eighteen coaches and 14 baggage and post-office cars are being constructed at Wilmington; 30 freight train conductors' cars at Toronto; 200 freight and stock cars at London, Ontario; and we are adding ourselves 150 flat and 50 stock cars.

"The whole Great Western system is now of the American or 4 feet 8½ inch gauge, all the car stock has been changed, and before snow falls all the broad-gauge engines and the third rail will be removed.

"Our passenger coaches, second class and smoking cars, are being rapidly improved and modernized, and large additions are being made to our stock of freight cars."

This certainly is a description of a railroad of the first class, and with these improvements completed the Great Western will certainly be able to accomodate all the traffic that may offer, and carry it at the minimum expense for maintenance.

Memphis & Charleston.

At the annual meeting of this company in Memphis, August 28, 76,410 shares were represented by person or proxy. A resolution was adopted instructing the directors hereafter to print with the annual report a list of stockholders, with amount of stock held by each. Another resoluton adopted was that all work and expenditures on branch roads owned and controlled by the company (not included in the lease to the Southern Security Company) be suspended, when it can be done without violating obligations already entered into, and that an effort be made to obtain the consent of contractors to such suspension.

Ohio & Mississippi.

The annual meeting of the stock and bondholders for the election of successors to the three directors whose terms will then expire, will be held at the company's office in Cincinnati, October 10. Transfer books are closed September 14, and will reopen October 14.

St. Louis & Mexican Gulf.

The St. Louis *Republican*, of August 29, says:

"Mr. Lauren Kellett, Engineer of the Atlantic & Pacific Railroad, has just completed the profile and maps of the St. Louis & Mexican Gulf Branch of Atlantic & Pacific Railroad. This

company was organized on the 1st of January last. Henry T. Blow and James P. Fiske were elected directors, and Col. Henry C. Young of Springfield managing director. Several New York parties will be here on Monday next to meet with the directors for the purpose of making arrangements for commencing work on that road at once. The proposed road will be 650 miles long, running from Springfield, Mo., to Sabine Pass on the Mexican Gulf. It passes from Springfield to Fayetteville, in Arkansas, thence to Fort Smith, and through Paris, in Texas, to the Sabine Pass."

Virginia & Truckee.

The last spike was driven at a point about one mile west of Carson City, August 24. Construction trains run over the road, but regular trains will not be put on until the ballasting is finished. The company is building a large freight and passenger depot at Gold Hill.

Lake Ontario Shore.

The track is laid from Oswego to Fair Haven, a distance of about 15 miles. The road will ballasted and regular trains running about September 20. At Fair Haven the road crosses the Southern Central Railroad, and trains from Oswego will run in connection with those on the Southern Central. Work beyond Fair Haven is progressing well, and the company expect to have the entire line open next spring.

Mississippi Central.

Work on the extension to Cairo was commenced at Jackson, Tenn., September 3. Messrs. George H. Tenney and J. N. Hiblord, of Illinois, have the contract from Jackson to Milan, and are to have the work completed by January 1.

Elizabethtown & Paducah.

The bridge across the Tennessee River is completed, and the first train passed over it September 5.

St. Louis & Florissant.

This company intends to build a narrow-gauge road for suburban traffic from Grand Avenue, St. Louis, through Mount Cabanne and Carsonville to Florissant, about 15 miles. The citizens of Florissant have voted to issue $25,000 in bonds of the town, for stock in the company. About $75,000 has been subscribed to the stock, and work will begin as soon as $150,000 is subscribed. The estimated cost of the road is $250,000.

Flint & Pere Marquette.

An officer of the company furnishes us with some facts concerning the Flint River and Cass River branches. The Flint River road leaves the main line between Flint and Mt. Morris and extends to Otter Lake, in the northeast corner of Genessee County, a distance of 15 miles. It was completed August 31. The Cass River road will extend from East Saginaw, east to Caro, a distance of about 30 miles. This road is to be put under contract at once, and will be ironed and completed next spring. These two branches are built to secure the lumber traffic of the Flint and Cass Rivers respectively. On the unfinished portion of the main line from Reed City to Ludington, 48 miles, a section of 10 miles is now under contract and cleared, and the balance is to be let this month. It is intended to have the whole ironed next year.

Chicago, Clinton & Dubuque.

It was hoped, when this company began construction, that it would be able to negotiate for the use of the track of the six miles of the Sabula, Ackley & Dakota, and the five miles of the Iowa Midland, which extend along the bank of the Mississippi, with which only about five miles of new line would be needed to complete the road between Clinton and Sabula. Not being able to make satisfactory terms with the Midland, however, the company determined to construct a line of its own the entire distance from Dubuque to Clinton. This road is now completed within 12 miles of Clinton, and is to reach the latter place by October. The company is ballasting the road thoroughly, intending to have it as good as the best in the State. Officers of the company have recently been negotiating for the extension of the line from Clinton down the river to Davenport and Burlington.

Denver & Platte Valley.

This company proposes to construct a railroad of the standard gauge from Denver to a point on the Julesburg branch of the Colorado Central road at or near Fort Morgan. It is claimed that such a road will shorten the distance from Denver to the Missouri River by 100 miles. The company has asked Arapahoe County, Col., for a subsidy of $300,000 in bonds. The officers of the company are: President, Gov. McCook; Vice-President, ex-Mayor Harper, of Denver; and Secretary, Henry Crow.

Maine Central.

The new iron bridge across the Androscoggin River, between Brunswick and Topham, is completed. It was just forty days from the time that the order was given for the iron to the time of its completion, ready for shipment. The time actually employed in putting the bridge in place was eighteen working days.

Penobscot Bay & River.

The officers of this company, with the President and other officers of the Knox & Lincoln Company, and Superintendent Lunt, of the Maine Central, have been making an examination of the proposed line of the proposed road.

Nashua & Rochester.

The contractors for grading and building this road have received orders to commence work at once, and a gang of men was set at work August 31. The road is 48 miles long. The contractors are Messrs. Hitchings & Lynch, of Portland.

Sheboygan & Fond du Lac.

The county, of Marquette and some two or three of the towns in that county have voted about $70,000 in aid of the extension of the road.

Wisconsin Central.

The Ashland (Wis.) *Press*, says:

"The Bay City railroad bridge is completed and the iron rails are laid upon it, and the good work still moves on. With pleasant weather, two weeks more will see the cars to White River. The construction-train now runs out about two miles from the dock."

Sioux City & St. Paul.

The track-layers were within 12 miles of Le Mars, Iowa, August 31, and it was expected that the gap would be filled within two weeks.

Milwaukee & St. Paul.

The people of La Crosse bitterly oppose the project of this company to construct a bridge over the Mississippi above the business portion of their town, which would make the route for through traffic a little to one side of the town. They have selected a route which will bring the foot of the bridge nearly opposite the business center and the track of the road through thickly-built streets. The company opposes this, as by it the through trains would have to run a mile or two south of the direct route and then back again, on a sort of U line.

The company has made surveys for a route from a point on the west side of the river at the village of Dresbach, several miles above La Crosse, almost due east to Winona Junction, which would pass about three miles north of La Crosse and leave that town at the end of a spur about three miles long. Such a line would save about five miles in the distance between Milwaukee and Chicago and St. Paul, and this is an important matter on a line which is likely to have so considerable a traffic. Nothing is determined yet; but the company is very unlikely to make the detour by way of Mount Vernon street, as desired by La Crosse.

New Minnesota Projects.

Engineers are making surveys for a narrow-gauge road from Minneapolis to Rochester.

A party is about locating a line for a branch of the Sioux City & St. Paul Railroad (the main line being nearly completed) to Winnebago City, the present terminus of the Southern Minnesota road.

There is some talk of ironing the Minnesota Northwestern Railroad from Wells northwest to Mankato; it has been graded about two years.

St. Paul and Minneapolis are discussing projects for street railroads to connect the two cities, in connection with the grand boulevards, etc.

The authorities are advertising for proposals for raising and constructing approaches to the suspension bridge, and also for the piers and superstructures of two new bridges, one iron and one wood or combination, over the Mississippi at Minneapolis.

St. Paul & Pacific.

A correspondent writes that work has been suspended on the St. Vincent Extension of this road between Alexandria and Glyndon, Minn. The track has been laid as far as Red Lake River, which is 64 miles north of Glyndon and within about 90 miles of St. Vincent. On the southern end of this branch the track has been laid to Spunk Lake, a short distance west of St. Cloud. Glyndon is on the Northern Pacific, ten miles east of the Red River at Moorehead, and the part of the road completed extends nearly due north from this point and parallel to the river. From Glyndon the other section will extend southeastward to St. Cloud, being nearly parallel to the main line from St. Paul to Breckinridge.

Work has been resumed on the Brainerd Branch, which will complete this company's Mississippi River line from St. Paul to the Northern Pacific crossing.

A preliminary survey is being made for a line from the Northern Pacific southward to Fergus Falls and Breckinridge—the latter the Red River terminus of the main line of the St. Paul & Pacific.

Northern Pacific.

A telegram from St. Paul, dated September 7, says:

"D. C. Linsley, Assistant Chief Engineer of the Northern Pacific Railroad, accompanied by Major Kellogg, of General Sheridan's staff, passed through here this evening on the way to the East. These gentlemen left the surveying expedition at the mouth of the Powder River, on the 18th ult. The party was three times attacked by hostile Indians while en route to the point of destination, but the enemy was repulsed by General Stanley's forces, each time without loss to any part of the expeditionary corps. They also report that the Indians declare they will fight the expedition to the death if they attempt to return East. Thirty days more of supplies are to leave the Missouri River crossing immediately, escorted by three companies of infantry."

The engineer party is now running the second line along the Bay front of Superior, from Conners' Point to mouth of Nemadji River, and it is supposed the company will commence the construction of the road at an early day.

Oregon & California.

Work on the road between Oakland, the present terminus, and Roseburg, a distance of about 20 miles, is rapidly progressing. The grading is nearly finished, and the bridge over the North Umpqua is all framed and ready to put up as soon as the pile-driving is done. It is expected that trains will run to Roseburg before the rainy season sets in.

A correspondent of the *German-American Economist*, writing from Oregon, says that the reports which have been published concerning the probability that the company will fail to meet the interest on its bonds and be unable to complete its road have been put in circulation by enemies of the company, among which he classes the Central Pacific, which he charges with the desire to get possession of the road, and especially of the land grant, and a certain clique of Democratic politicians, who, he says, are enraged at the active part taken by Ben Halladay in the last election, which resulted in their removal from power. He claims that the property will earn enough to meet its obligations. Ben Halladay, President of the company, he says, is pretty sure to be chosen to the United States Senate at the next session of the Legislature.

Oregon Central.

The Portland (Oregon) *Bulletin*, of August 23, says:

"This morning, on the first trip of the dirt train up the West Side road, bridge No. 3 was discovered to be on fire. The train was stopped, and the men proceeded to put out the fire and ascertain the amount of damage done. A lot of brush and wood had been collected beneath it, placed alongside of the bridge timbers and set on fire. One of the supports of the bridge was burned, although the damage done was not so bad as to prevent the trains crossing it. The evening before a fire was built almost within the limits of the city, at bridge No. 1."

Portland & Ogdensburg.

The track is laid three miles west of Hardwick. Large quantities of lumber and dairy products are now sent over this road to the Passumpsic River road and thence to Boston.

Hoosac Tunnel.

The progress of the Hoosac tunnel during August was as follows: East end, 138 feet; west end, 150 feet; central shaft, eastward, 109 feet; westward, 0. Total length opened to September 1: east end, 10,823 feet; central shaft, 1,467 feet.

Connecticut Central.

The building of this railroad from Springfield, Mass., to Portland is now considered sure, as a majority of the taxable property of East Windsor has been pledged to a subscription of $60,000 on the part of the town.

Boston & Maine.

The contractors' train on the Maine extension reached the Portland, Saco & Portsmouth Railroad crossing, on the Saco road, on the evening of September 7.

Memphis, Carthage & Northwestern.

Crawford and Shawnee townships in Cherokee County, Kansas, have each subscribed $10,000 to the stock of this company, thus securing the immediate construction of the road to Columbus, Kansas. On the line west of Columbus work has already commenced, and stone is being quarried for the bridges, culverts, etc.

Manhattan & Burlingame.

A railroad is proposed to run from Manhattan, Kansas, which is on the Kansas Pacific Railroad, 118 miles west of Lawrence, southeast through Wabaunsee, Alma and Eskridge to Burlingame, on the Atchison, Topeka & Santa Fe road, 77 miles southwest of Atchison. The length of the road would be about 52 miles.

Maryland & Pennsylvania.

The act of incorporation of this company has been filed in the Executive Chamber at Annapolis, Md. The incorporators are William C. Leslie, of Philadelphia; Samuel S. Davis, John J. Fenton, Thomas J. Shaw and Beaman Lawrence. The termini of the road are the city of Baltimore and a point on the Pennsylvania line where said line crosses Octorara Creek in Cecil County, passing through Baltimore, Hartford and Cecil counties. Capital stock, $800,000; shares $50 each. This line would run northeast from Baltimore a distance of about 40 miles, and for most of the way would be nearly parallel with and from six to eight miles from the line of the Philadelphia, Wilmington & Baltimore Railroad.

South & North Alabama.

The Mobile *Register* says that this road was completed to Blount Springs, about 53 miles from Decatur, September 7. This leaves a gap of about 33 miles to be filled from Blount Springs to Birmingham. From Birmingham the road is now in operation to Montgomery.

Burlington & Missouri River in Nebraska.

Regular trains began to run September 3 through between Plattsmouth and the western terminus of Kearney Junction, a distance of 191 miles, the section between Lowell and Kearney Junction, 15 miles, having been completed. This road has a fine country on the route, for the most of which it is the only convenient outlet, most of the roads now completed not being near enough to compete seriously, except at a few points. The road is exceedingly well placed with reference to the direction of traffic, being an outlet both to Chicago and to St. Louis, with which latter place it has direct and friendly connections. The distance from St. Louis to Kearney Junction by this route is 612½ miles, whereas by way of Omaha it is 670 miles. The value of the line, however, will be doubtless almost entirely as an outlet for the traffic of the country on the road; and when this is fairly developed it is likely to afford a large traffic.

Burlington & Missouri River.

The land sales of this company for the month of August, 1872, were: 31 sales in Iowa, 2,378.80 acres, average $13.48-8, $31,783.06. 111 sales in Nebraska, 14,007.97 acres, average $8.32-5, $116,622.36. Total sold in August, 16,586.77 acres, for $11,405.42.

Total sales to September 4, 1872: 2,034 sales in Iowa, 173,638.84 acres, average $11.75-7, $2,041,607.76. 1,946 sales in Nebraska, 254,942.09 acres, average $8.49-3, $2,165,158.40. Total in both States, 428,580.93 acres, for $4,206,766.16.

The company have yet for sale: In Iowa, about 185,500 acres; in Nebraska, about 1,375,000 acres.

Ne York Central & Hudson River.

The board has determined to make the usual half-yearly dividend of 4 per cent., doubtless to the disappointment of many who, on the strength of speculative reports, expected a 5 per cent. dividend.

Southern Westchester.

At a meeting of the shareholders of this company in New York on the 10th, an agreement was made to consolidate with the New York, Housatonic & Northern Railroad Company. The latter company's line, which is completed for a few miles, extends from the Harlem Railroad at White Plains 30 miles north of New York, northeastward about 40 miles to Brookfield, Conn.; and the Southern Westchester is intended as an extension from White Plains southwestward about 20 miles to the Hudson just above New York.

California & Oregon.

Regular passenger trains commenced running to Redding, September 1. The track has been laid to that point for several weeks. Redding is 175 miles from Sacramento and 40 miles from Red Bluff, the late terminus.

Benicia & Red Bluff.

Efforts are being made to form a company to build a narrow-gauge railroad from Benicia to Red Bluff, with branches from Vaca to Sacramento, from Cache Creek to Colusa, and from some point not yet fixed to Nevada. The entire length of the road and branches would be about 260 miles. Benicia is asked for a subsidy of $200,000, and Sacramento for $300,000.

South Mountain.

The line of this road runs from Harrisburg in a northeasterly direction to Hamburg, on the Schuylkill, 16 miles south of Pottsville, Pa. The length of the line as surveyed is 45½ miles. The road connects at Hamburg with the main line of the Philadelphia & Reading Railroad, and at Jonestown with the Lebanon & Tremont Branch of the same road. The line is nearly parallel to and about half way between the Lebanon Valley Branch of the Reading road and the Schuylkill & Susquehanna Branch of the same road. Mr. W. H. Bell, of Branchville, Sussex County, N. J., is President of the company.

Parker's Landing & Fairview.

A company has been organized to build a narrow-gauge road from Parker's Landing, on the Allegheny River, northwest through Butler and Mercer Counties, Pa., to Fairview, a distance of about 40 miles. It is expected that such a road will secure a large oil traffic. One-fifth of the stock has been taken, and engineers will be put on the line at once.

Painesville, Warren & Pittsburgh.

The survey of this road has been completed, the profile drawn and an estimate made on the cost of grading, &c., and sent on to the Pennsylvania Company's office.

Coldwater & Northwestern.

This company, which intends to build a railroad from Lima on the Dayton & Michigan road to Columbus, is making efforts to complete their road. They have already graded the roadbed from Bellefontaine to Marysville, a distance of 24 miles.

Lake Shore, Midland & Western.

The preliminary survey of this line from Kendallville, Ind., west to the Illinois State line in Newton County, has been completed. The line is about 130 miles long. Kendallville is on the Lake Shore & Michigan Southern road, 101 miles west of Toledo.

Wilmington & Western.

The work on this road is progressing rapidly. The bridge over the Christiana is ready for the rails and the extension of the road to the wharves on the river is nearly done. The bridge is 489 feet from bank to bank, and the bridge and approaches are 741 feet long. The bridge is built on 369 piles, 125 of which support the draw-pier, which is built of Port Deposit granite. The draw is 165 feet long, with two passageways for vessels, each 70 feet wide. This bridge was built by Cranston & Thompson, of Newport, and is of wood. Four locomotives, five passenger and thirty freight cars have been received and are ready for use. Beyond Cuba Hill, to which point the road is now finished, the work is nearly done, and it is expected that the road will be opened to Landenburg by October 1.

Kansas City, Memphis & Mobile.

The Kansas City *Journal of Commerce* says that the County Court has ratified the transfer of the Clinton Branch of the Tebo & Neosho Railroad to this company, and that the company has now full power to construct its road to the Arkansas line. A suit for an injunction is, however, still pending.

Lawrence & Topeka.

This road is now graded from Lecompton to Topeka, about 18 miles, and ties are being delivered along the line.

American Fork.

Eight miles of track have been laid on this narrow gauge road in Utah, and the work is progressing rapidly.

Portland & Ogdensburg.

At the annual meeting of the Lamoille Valley Railroad Company, which is constructing the Vermont Division of this road, the President, Mr. Bingham, reported that cars are now running to Hardwick, 35 miles from St. Johnsbury. The roadbed from Hardwick to Hydepark, 17 miles, is so nearly completed that it will require not more than $20,000 to fit it for the iron. A large part of the heavy work on the line from Hydepark to Swanton, 48 miles, is done; and of this a section of 23 miles, from Sheldon to Swanton, is nearly ready for the rails. The President assured the stockholders that $170,000 will complete the road from Hardwick to Swanton, and that the financial condition of the company is sound.

New York & Montreal.

The Matteawan (N. Y.) *Journal* says that the line of the Dutchess Division of this proposed road, as located, runs from the east end of the Michael Hollow embankment along the west slope of Pisgah, into the valley of the middle branch of the Croton, and thence over the divide into the valley of the Fishkill, following that valley to Sylvan Lake. From Sylvan Lake to the Dutchess & Columbia road, about four miles, a railroad, known as the Clove Branch, has been in operation for several years. A party is now locating the line from Clove Branch Junction, on the Dutchess & Columbia road, to a point at or near Chatham, on the Harlem Extension road.

New York & Harlem.

The Board of Engineers of the "Fourth avenue improvement," which is the tunneling and bridging which are to make this line free from grade crossings within the city of New York, advertise that they will receive proposals until September 30 for all the work between Seventy-ninth street and the Harlem River, including a very large amount of excavation, tunnels, walls and bridges. Specifications, etc., are now ready at the office in the Grand Central Depot.

New York Underground Railroad.

The New York *Times* reports Mr. Buckhout, the engineer in charge of this work, to have said:

"I hope to commence work at both ends of Commodore Vanderbilt's underground railroad, namely, at City Hall and at Fifty-sixth street and Fourth avenue, on or before the 15th inst." The depot at the City Hall will be opposite the north end of the Post Office, facing Beekman street, and will be 112 feet long and 50 feet broad. The track at this point will be sunk about nineteen feet below the street level. There are to be eight stations along the road. The route of the new road is to be as follows: From the City Hall Park it curves into Center street, near the Register's office; then in Center as far as Reade; then it runs through the center of the blocks south of Park street, crossing Duane, Pearl, Baxter, Worth, Mulberry, Mott, Doyer, and Pell, the latter situated in the close vicinity of Chatham square, where it reaches the Bowery. Following the Bowery until Cooper Institute is reached, the road diverges into Fourth avenue, passing to the east side of the Grand Central and along to Fifty-sixth street, where it will connect temporarily with the Harlem Railroad. From Thirteenth to Eighteenth street the road will lead through solid rock. At the Murray Hill tunnel, running from Thirty-fourth to Fortieth streets, the line will be underpinned—which means that a second tunnel will be built and the Fourth avenue cars will run over the underground railroad tunnel. The top of the tunnel will be, on an average, three feet below the street's surface. Mr. Buckhout is hopeful that the down-town portion of the road will be constructed within two years, but the up-town portion, on account of the engineering difficulties, will probably take longer. In a few days commissioners will be appointed to appraise some property in the vicinity of the Five Points, where a depressed road will be built, and about which a disagreement as to price has occurred between Commodore Vanderbilt and the owners.

Chesapeake & Ohio.

This company, whose road is now nearly completed, and, we learn from those who have seen it, completed in a thoroughly permanent manner, is about to offer the unsold remainder of its mortgage bonds, amounting to $2,923,700, for proposals up to September 16. The total amount of bonds is $15,000,000, of which twelve million and more have been sold at prices varying (for a 6 per cent. bond) from 90 to 94. No minimum price for the bonds is fixed, but the agents reserve the right to refuse any and all proposals. This method is the common one in London, but it is almost unknown here.

The company reports that the western section of 200 miles of the road, where a heavy mineral traffic is expected, will be nearly all laid with steel rails.

Nashville & Chattanooga.

At the annual meeting of this company, August 14, resolutions were passed notifying the purchase by the directors of a two-thirds interest in the Nashville & Northwestern Railroad, the settlement made by them with the State of Tennessee, and their contract with the Louisville & Nashville Company in relation to a union depot at Nashville. The board was authorized to issue first-mortgage bonds to an amount not exceeding $20,000 per mile on all the company's lines, including the Nashville, Memphis & St. Louis Railroad (the new name of the Nashville & Northwestern) in lieu of $3,000,000 of second-mortgage bonds previously authorized, the new issue to provide for the retirement of the outstanding funded debt.

Mississippi. Ouachita & Red River.

On this road 30 miles of track are laid and 85 miles graded, leaving less than 50 miles of grading to be done. The road is to extend from Eunice, Ark., on the Mississippi, west to Fulton, on Red River.

Ware River.

An exchange says: "Work has been abandoned for some time on the second, third and fourth sections of the road, as parties who proposed to complete the road refused to do anything as long as the first section was leased to the New London Northern Railroad. It has now been mutually agreed by all parties interested in the lease of the first section that the lease shall be surrendered as soon as the whole road is completed, and it is now expected that work will be immediately resumed, and that the entire road will be completed and the cars running from Winchendon to Palmer by January 1, 1873."

Dover & Portsmouth.

The preliminary survey of this road is now being made. The City Council of Dover, N. H., voted, August 26, to subscribe $225,000 to the capital stock of the company.

Sugar River.

This road was to be opened for travel the first week in September, thus completing a new route from the West to Concord, by way of Claremont and Bradford.

Manchester & Keene.

The town of Harrisville, N. H., has voted 5 per cent. of its valuation, or about $17,500, to this company. The town of Marlboro has voted 5 per cent. of its valuation to aid in the construction of the road, the amount to be paid in money or bonds when the road is completed, on condition that the road is built on the the basis of what is known as the "Walker Survey."

Connecticut River.

A meeting of the stockholders, at which 3,743 shares were represented, was held in Boston, September 3, to consider the acceptance of certain acts of the last Legislature authorizing the road to lease that portion of the Vermont & Massachusetts Railroad between South Vernon and Brattleboro, and to issue stock or guarantee bonds of any other road to the amount of $200,000 for the purpose of extending their line through Vermont and New Hampshire, also to secure a right of way over any of the connecting roads in Vermont, and authorizing the company to increase their capital stock to $300,000. These acts were accepted by a unanimous vote, and the matter referred to the directors with full power.

Walkill Valley.

The first train to enter Kingston reached that town September 4. Regular trains will be put on as soon as the road is ballasted. Kingston is about seven miles beyond Rosendale, the late terminus of the road.

Poughkeepsie & Eastern.

The last rail on this road was laid September 4, at State Line, N. Y. Regular trains will be put on as soon as the ballasting is completed, probably about October 1. State Line is on the Connecticut Western Railroad, one and one-half miles east of Millerton. The road has been worked for some time to Pine Plains, 26 miles from Poughkeepsie. From Stissing northwestward to State Line, 25 miles, the track has been laid this year.

Delaware, Lackawanna & Western—Morris & Essex Division.

The route for the connecting line across the meadows, which is to unite this road with the Newark & New York road, east of the Passaic, is now being laid out by the engineers. For a portion of the distance the ground is comparatively solid, and the crossing of the New Jersey track at the Fish House is the only difficult piece of work to be done.

Erie.

Wall street has been manufacturing or giving currency to reports that the company is sadly in need of money, having a large floating debt, which is continually increasing, and an empty treasury, the receipts being insufficient to meet the working expenses; and that the board is likely to issue $25,000,000 of convertible bonds.

That the road is not making money very fast is entirely probable; that it does not earn enough to meet working expenses seems highly improbable; and the manner and places in which these rumors are circulated makes their truth improbable on general principles.

At a meeting of the board on the 10th a contract with the New York, Boston & Montreal Company was ratified, by which it is understood that, when the latter road is built, the two roads will exchange traffic. This road has a good deal of grading done and some track laid; if it shall make harmonious connections with the New England railroads, especially the Southern New England roads, it may become of great value to the Erie, which has always needed such connections as would enable it to send freight to New England direct, without transfer at New York.

Mercer & Somerset.

Work on the section between Pennington and Hopewell, N. J., is going forward, a considerable force being employed. The road, which is intended to run to Millstone, has been for some time in operation from Somerset Junction, on the Belvidere Delaware road eight miles north of Trenton, northeast to Pennington, about 4½ miles. The distance from Pennington to Hopewell is about six miles, and the whole length of the road, when completed to Millstone, will be about 23 miles. For nearly four miles north from Pennington the road runs parallel to and not more than 100 yards from the line of the National Railway. The road was leased and operated by the United Companies of New Jersey, and was included in the lease to the Pennsylvania Railroad Company. In connection with the Belvidere Delaware on the west and the Millstone & New Brunswick Branch on the east, it will form a loop line to the New Jersey Division between New Brunswick and Trenton.

Leavenworth, Lawrence & Galveston.

This company is building extensive machine shops at Ottawa, Kansas.

Philadelphia & Reading.

The people of Upper Uwchlan having taken steps toward extending the Pickering Valley Branch from its present terminus at Byers' Station to Milford, on the East Brandywine & Waynesburg road, the company has agreed to have the necessary surveys made at once.

New Pennsylvania Railroad.

A new railroad is about to be built from Northumberland, Pa., along the west side of the Susquehanna River, through Selinsgrove, Port Trevorton, McKee's Half Falls, Liverpool and New Buffalo, connecting with the Pennsylvania Railroad at the mouth of the Juniata River. This new road will run through a beautiful and thickly-settled country, at present almost destitute of railroad facilities. The enterprise is largely in the hands of Philadelphia capitalists.

Philadelphia, West Chester & Downingtown.

The contractors for the section of the road between Philadelphia and West Chester have been ordered to push the work forward as fast as the engineers can mark it out.

Harrisburg & Potomac.

An engineer party is now locating the line between Funkstown and Fayetteville. The work is to continue down the valley until another party is met, which is working north from the Baltimore & Ohio Railroad, from the direction of Hagerstown.

Peachbottom.

The estimated cost of the grading and masonry on the Eastern Division from Peachbottom to Oxford in Chester County, about 13 miles, is $54,600. The subscriptions to the stock on the Eastern Division amount to $62,000. The road is to be of narrow gauge.

Pennsylvania—New York Division.

In addition to the side tracks for freight which have been laid down at Meadow Switch, west of the Hackensack River, the foundations for large buildings, to be used as a round-house and machine shops, are begun. It is said that as soon as these are completed the present shops in Jersey City will be removed. Work on the Harsimus Cove improvements is beginning to show some progress, two lines of made ground projecting some distance into the Cove. The material principally used is street dirt from New York, which is brought over on scows and distributed by a small locomotive and cars.

The Newark *Advertiser*, of September 10, says:

"A novel case was heard before Police-Justice Street, in Trenton, on Friday. Mr. A. S. Livingston lodged complaint against the Pennsylvania Railroad Company for having blocked East State street, Trenton, with freight trains, on Monday and Wednesday of last week. The proceedings were under a city ordinance, which provides that a fine of $20 may be inflicted for every offence. The railroad authorities, by their agent, pleaded guilty, on Friday, and were fined the sum of $40 and costs. The railroad authorities have notified all their employees that if, in the future, they are the cause of blocking up the streets of a city, they must pay the fines or be discharged."

Rochester & State Line.

Work was commenced on the Warsaw Division of this road at Warsaw, N. Y., September 5. The road is to be completed from Rochester to Salamanca in one year.

Wilmington & Reading.

The work on the extension from Birdsboro to Reading is nearly completed. Three bridges across the Schuylkill are required, and as soon as these are finished the rails can be laid. The projected branch from Springfield, up the Conestoga Valley into Lancaster County, has been given up for the present, because the surveys of the Lancaster & Delaware River Railroad pass over the same route as the branch.

Bedford & Bridgeport.

The machine shops and round-house are to be located at Bedford, though a strong effort was made to have them at Cumberland.

Junction & Breakwater.

The Milford (Delaware) *News and Advertiser* says: "The Lewes and New York steamers started, this season, on a bargain between the owners and the Junction & Breakwater Railroad managers, for the former to buy the road. Under this agreement the respective parties met in Milford on Thursday week to close the contract and transfer the control of the line. The New York parties brought with them expert accountants to examine the books of the company and see that its condition and resources were as had been stated. This examination resulted in proving so entirely different from what they had been led to believe was the condition of the road, that they unhesitatingly declined to go any further with the business. They state that they were assured that the road paid all its expenses, including the interest on its debts and surplus, while they found on examination that its running expenses from January 1 to August 1, 1872, were absolutely more than its gross receipts, leaving the interest on its debt and the amount of taxes due the State wholly unprovided for, thus proving it to be a sinking fund to its owners of $25,000 per annum. The New York men have lost about $8,000 in running the steamship line so far, and as the managers of the road would not participate in the loss, they could do no less than withdraw the steamers."

Baltimore & Ohio.

The Wheeling *Intelligencer*, of September 7, says: "The Baltimore & Ohio Railroad Company is extending its double track west of Piedmont as rapidly as it can be done. Already the "seventeen-mile grade" is nearly furnished with the second track, and by the close of the present month Newburg will be reached from Grafton. Along the line between Altamont and Newburg gangs of men are at work widening the road-bed for the additional track. Within the next twelve months this will probably be completed. We hear that orders have been given to double track the Parkersburg Branch also."

Washington, Cincinnati & St. Louis.

The Staunton (Va.) *Vindicator*, of recent date, says of this projected narrow-gauge road: "The President and Chief Engineer of this road have just returned to Harrisonburg from a trip over the Virginia and West Virginia portion of the line, as far as Pocahontas County, west of the Allegheny Mountains. They found a practicable route by way of North River Gap, a low point in the Shenandoah Mountains, thence to Monterey, Highland County, through a low gap in the Allegheny Mountains opposite Big Spring Branch, the headwaters of the Elk River. All of this portion of the line can be constructed with moderate grades and curvatures, not exceeding those of the Chesapeake & Ohio and Western Maryland roads, and without a tunnel on the line. Mr. Osborne has returned to Delaware, where he will organize a corps of engineers and return to survey the road west of Harrisonburg during the next month.

Washington & Georgetown.

The quarrel between the Board of Public Works and the company has come to an end. Mr. Justice Humphreys delivered his decision on the 31st ult., enjoining the board from changing the track of the road, refusing an injunction against the road, and discharging the rule against the same at the suit of the board.

Dunkirk, Warren & Pittsburgh.

This railroad, which has been in operation from Dunkirk south to Warren, 54 miles, one year, and is intended to form a connection between the New York Central and the oil regions of Pennsylvania, has been extended from Warren west to Irvineton, Pa., six miles, and regular trains are now running. Work is rapidly going forward on the extension to Oil City (Warren & Venango Railroad), a large force of men being engaged in grading.

New Lisbon & Salineville.

This company, which intends to build a railroad from New Lisbon, Ohio, south about 10 miles to Salineville, on the Cleveland & Pittsburgh road, 87 miles from Cleveland, filed its certificate of incorporation with the Secretary of State of Ohio, September 3. The capital stock is $150,000, in shares of $50. The corporators are: Wm. W. Orr, John T. Dysart, John M. Irvin, Wm. Faloon and Robert McGonagle.

Muskegon & Big Rapids.

Ten miles of the line out from Muskegon is ready for the iron, and the rails have begun to arrive. Work has also been commenced on the Big Rapids end of the road.

Marquette, Houghton & Ontonagon.

Grading is nearly completed from Marquette to Spurr Mountain. It is expected that the road will be completed to L'Anse before winter.

Cleveland, Mount Vernon & Delaware.

The iron bridge over the Kokosing at Mount Vernon is completed, and the road eastward is being ballasted. It is intended to have regular trains running to Cleveland by November 1.

Toledo, Peoria & Warsaw.

This company has commenced the construction of an extensive freight house and offices at Burlington, Iowa. The freight house will be 200 feet long by 30 feet wide.

Peninsular.

The Cass County (Mich.) *Republican*, of September 5, says that the work of laying the iron between South Bend and Valparaiso is progressing rapidly and will be finished in three weeks. Valparaiso is on the Pittsburgh, Fort Wayne & Chicago Railroad, about 45 miles from Chicago.

St. Paul & Sioux City.

A route has been surveyed for a branch from Lake Chrystal nearly due south to Blue Earth City, Minn., a distance of about 35 miles. The line runs about four miles west of Winnebago City.

Green Bay & Lake Pepin.

The point selected for the junction with the West Wisconsin road is Merrillon, in Jackson County, Wis. It is reported that contracts are to be let for work from that point eastward, so that work will go on from both ends of the line.

Milwaukee & Northern.

The track is laid to New Holstein, about 17 miles from Plymouth, the late terminus.

Muscatine, Kewanee & Eastern.

Articles of consolidation between this company and the New York Western Railway Company have been filed in the office of the Secretary of State of Iowa.